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THE ATROPHY OR MARASMUS OF INFANTS :
A STUDY WITH SPECIAL REFERENCE TO AETIOLOGICAL FACTORS.

being

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J. A. Bruce Young M.B., Ch.B. (Edin.)

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THE ATROPHY OR MARASMUS OF INFANTS: A STUDY WITH SPECIAL REFERENCE TO AETIOLOGICAL FACTORS.

Failure of nutrition in infants is often Secondary to congenital disease, e.g. congenital syphilis, or again, Secondary to some debilitating illness such as severe broncho-pneumonia, or enteral infection. In other cases of infantile atrophy, no specific cause for the wasting can be found. The failure of nutrition in such primary or idiopathic cases of atrophy is frequently ascribed to improper feeding, especially of the nature of faulty proportioning of the basal constituents of the food mixture. Yet many infants have been successfully reared from birth upon food mixtures in which the proportions of fat, protein, carbohydrates, and salts were far from physiological. It would seem therefore that improper feeding is only one factor in the production of idiopathic atrophy.

Recent work upon accessory food factors has shown the vital importance of these elements in the nutrition of infants. In many

respects the decline of the marasmic infant who is ingesting a sufficiency of food, not vomiting, and not showing signs of organic disease, is analogous with the waning of the young experimental animal deprived of vitamins.

In this Thesis it will be suggested that idiopathic infantile atrophy frequently results from deficiency of fat - soluble vitamins, and that the condition may be a manifestation of rickets, but that other aetiological factors contribute to the production.

Inasmuch as the Thesis is an attempt to elucidate the aetiology of marasmus, current views upon treatment will not be discussed, but the writer will quote records of two series of cases treated in hospital practice. The second series is of some interest in view of the dietetic treatment adopted being a departure from that more commonly employed.

The material which follows is arranged under the sub-joined headings:-

I. Clinical picture of infantile atrophy.

II. Modern views upon aetiology and pathogenesis

Clinical picture.

The clinical picture of marasmus is very characteristic. The face looks old and pinched, and the forehead wrinkles upon slight movement of the eyes. The skin is wrinkled, dry and toneless, hanging in folds on the extremities, while the bony points stand out prominently owing to the loss of subcutaneous fat. Generally the abdomen is protuberant, and owing to thinning of the walls in severe cases there may be visible peristalsis. The fontanelle is depressed; the eyes are large. Some of the infants are completely apathetic, taking little or no interest in their surroundings; others are fretful, and resent handling. In most cases they sleep but little, though the bodily movements are slow and infrequent.

Other features may be summarized briefly.

1. The appetite is variable, but is usually poor: occasionally they are ravenous, and feed greedily. In such cases the fingers may be constantly sucked as if in an effort to appease hunger. Vomiting after feeding is common.

2. The temperature is characteristically subnormal (96^{o} to 98^{o} F.), an irregular course being the rule. When fever is observed, in the absence of other cause, the onset of "intoxication" is to be feared. Similarly, a very low temperature maintained for some days may initiate the state of "decomposition."

3. The weight curve may remain stationary, or may fall slowly but surely. Both these types of weight curve are very frequently observed, and the latter type frequently gives rise to the stationary variety when improvement is manifest in the child's general condition: after remaining stationary for days or some weeks, with increasing improvement in nutrition the weight curve turns upwards again.

In unfavourable cases a rapid fall is often seen. This has generally been preceded by a stationary period, or more frequently by a weight curve showing a steady weekly decline. When the rapid fall occurs it is accompanied by disturbances of temperature and consciousness. Diarrhoea is present, and the outlook is ominous.

4. The pulse is feeble, and may be either slow or rapid. The blood is thin and

pale: a count reveals a low haemoglobin content, and a diminished number of red cells.

5. A peculiar feature of some cases is the rigidity of the leg muscles. In severe cases when diarrhoea is present this rigidity may be more or less generalised, and opisthotonos develop. The appearance of the infant may then suggest posterior basic meningitis.

In other cases, and more commonly in the writer's experience, the babies are extremely limp, and the muscles flaccid.

6. There is nothing characteristic about the stools except their extreme variability. They are seldom normal. Sometimes they are green, but as often they are pale and soapy. Constipated stools may alternate with relaxed motions, and on the same diet a marasmic infant may produce successive stools of varying character and appearance, even within twenty-four hours.

Complications.

Oedema is a common complication, and attention is often called to its presence by an unexpected gain in weight. It is generally first seen in the feet, and on the backs of the hands, and ultimately may become generalised. It is of grave prognostic

omen. Still has observed that the earliest manifestation of oedema is often a peculiar watery translucent appearance of the skin of the face.

Marasmic infants are particularly prone to infection of all kinds. Otitis media is extremely common, and infections of the skin, lungs, and alimentary tract are very frequent. Pyelitis is also common: It may precede the wasting, or be secondary to it. Sometimes purpuric eruptions appear upon the skin. These are of evil omen.

In a considerable proportion of the writer's cases, the marasmic state has been accompanied by indubitable signs of rickets, even in very young babies.

Some modern views upon aetiology and pathogenesis of Marasmus.

The work of Czerny.

In 1907 Czerny formulated a conception of Marasmus which marked a great advance in the elucidation of this condition. He regarded it

not as a disease per se, but as a disturbance in growth and in general nutrition; a result of nutritional disturbances or of infective processes, or both. All children subjected to such conditions did not become atrophic, and he formulated that those who did become atrophic were the victims of a constitutional anomaly. They were either suffering from the "exudative diathesis," or were the offspring of "neuropathic and psychopathic parents," and had an inherited hyper-excitability of the intestinal tract. Or again, that they were endowed with the "hydriopic constitution," that is to say, showed differences in salt and water retention from normal children.

Given the constitutional factor, the actual onset of atrophy might be caused by over-feeding with fat. The syndrome resulting from this particular error in feeding he differentiated as Milchnährschaden.

Another error in feeding which might precipitate the onset of atrophy was the giving of excess of carbohydrate,(frequently starch) in the food. With this excess of carbohydrate, a deficiency of fat and protein is frequently combined, as for example in a weak sweetened condensed milk mixture. He recognised a definite clinical syndrome resulting from

feeding on such a diet, and differentiated this type as Mehlnährschaden.

According to Czerny protein never causes digestive disturbance. Prior to his work, protein had been regarded as the most potent factor in producing digestive derangement in infants, but he was able to prove that the curds found in infants' stools are nearly always fat.

He believed that atrophic infants have a low assimilative power for fat, and that as a result of fermentation and digestion, fatty acids are formed in excess in the intestinal tract. To neutralise these fatty acids, alkalies are drawn from the tissues, excreted into the intestine, and lost in the stool. In consequence, demineralisation of the body is produced, and is the essential cause of atrophy. He based this"demineralisation theory" upon the experimental work of Keller, and Steinitz. It may be said here that both this experimental work, and Czerny's theory have been criticised considerably, and the conclusions apparently refuted.

Holt, Courtney and Fales, and Utheim have shown that many atrophic infants do not

have a low assimilative power for fat. This conclusion is supported by the admirable experimental studies of Parsons of Birmingham, whose work is conspicuous by the thoroughness of his experimental conditions. The latter observer seems to have shown that in infantile atrophy fat indigestion occurs only under two conditions.

1. When diarrhoea develops.

Here owing to the rapid passage of food through the intestine, fat splitting may be poor.

2. When high fat content dried milks are given.

With such feeding, fat splitting is always good, yet there appears to be an unnecessary strain upon the infant's digestive capacity which may ultimately result in intolerance for fat.

The Work of Finkelstein.

In 1912 Finkelstein published his celebrated classification of nutritional disorders. His views have been widely adopted by many American and Continental clinicians, and in this country by the great Edinburgh paediatrician, Dr.John Thomson. Finkelstein's classification

is based upon a study of the weight chart, and is largely a clinical classification.

In Finkelstein's opinion, the sugar and salts of the infant's diet are responsible for the production of atrophy. He based this view largely on the whey exchange experiments of Meyer, which experiments have been repeated more recently by Lichtenstein and Linberg, and apparently disproved.

According to Finkelstein, the whey salts may injure the intestinal mucosa, and decrease its normal secretion, depress the antibacterial function of the cells, and thus allow the growth of bacteria which produce sugar fermentation. The injured mucous membrane allows the passage of harmful substances, lactose and salts, into the circulation, and is itself (the mucous membrane) liable to bacterial infection. Variations in the salt content of the whey are held to be responsible for the zig-zag character of the weight chart of hand fed infants. He carried out upon atrophic infants, a series of clinical experiments with salt and sugar solutions, and from these concluded that the fever of alimentary intoxication is "salt" and "sugar fever," due to injury to cells by the

physico-chemical effect of the sugar or salts. He explained the rapid loss of weight in atrophy as being due to pathological loss of water, and assumes that the water combining power of the different cells of the body has been lost, and that as the result of the lack of retention of water there is a lack of retention of nitrogen and alkali.

Finkelstein's views, like those of Czerny have not escaped criticism, and Balcar, Sansum, and Woodyatt have pointed out that the solutions employed in Finkelstein's clinical experiments were strongly hypertonic. Isotonic solutions they found not to produce the symptoms which follow the injection of hypertonic solutions. Other points in Finkelstein's experimental findings are also criticised by these American authors who conclude that "sugar and salt fever" in infants is caused by dehydration, and does not result from cell damage.

The type of case which Czerny has described as resulting from intolerance for fat, is called by Finkelstein, Bilanzstörung (Disturbance of Balance). The latter observer considers that the intolerance for fats is secondary, and dependent upon derangement of the relations of metabolism

of carbohydrates to the fat. There is failure to gain weight.

Dyspepsia.

Under this heading Finkelstein considers the fretful type of atrophic infant with mild attacks of diarrhoea. Here the weight slowly falls. Infants in this category have diminished tolerance for carbohydrates, and mild sugar fermentation is commencing.

If this condition does not improve, or if improperly treated the infant passes into one of the two following categories :-

Alimentary Decomposition.

The weight falls slowly but steadily: The condition of atrophy or marasmus. It is thought to result from feeding on a mixture rich in fat, and relatively poor in carbohydrate.

Alimentary Intoxication.

The result of whey salts having found their way into the general circulation through the damaged gastric and intestinal mucosae. The error in feeding is giving excess of sugar and relatively little fat. The weight curve drops rapidly.

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Whatever criticisms may be levelled at Finkelstein's views, it is none the less true that many cases of infantile atrophy can be conveniently classified as he has done, by making use of the weight chart.

The Work of Marriott.

Marriott believes that atrophy is essentially the result of partial starvation, continued for long periods of time. He finds that there is a negative mineral salt balance, and in severe cases of atrophy there may also be a negative nitrogen balance, showing that there is destruction of the body tissues.

"There is diminished functional capacity of the body to oxidise organic material, and the basal energy metabolism of athreptic infants is often high as compared with those who are normal. The destruction of body substance is not confined to the solid portions of the organism, but affects the blood as well. There is a diminution in blood protein, a destruction of blood corpuscles, and a decrease in the total blood volume, resulting in a diminished blood flow, which brings about a lowering of the functional capacity of all parts

of the body. When the blood flow is increased there is a return of normal function."

The well-known clinical fact, that atrophic infants may have a stationary weight for a long period, in spite of a considerable ingestion of fluid, is probably due to this phase being a "period of repair," during which the functional capacity of the body for utilising food is returning. Experiments on animals suggest that the restoration of blood volume is occurring during this period.

Marriott considers that one of the chief reasons why atrophy develops on cow's milk feeding, and not on breast milk, lies in the different buffer valves of the two milks. There is little difference between their acidity values: PH for human milk is 7·0 to 7·2., and for cow's milk 6·6 to 6·8, but the alkali reserve (buffer value) of cow's milk is very much greater. The buffer value of cow's milk may be lowered by diluting with water, adding carbohydrate, or by artificially souring the milk by lactic acid organisms, or by the addition of hydrochloric acid. The "protein milk" devised by Finkelstein has also

a lower buffer value.

Representative French Opinions.

Nobécourt recognises two clinical syndromes, hypotrophy and cachexia. Each of the two syndromes is subdivided into (1) essential or protopathic, and (2) secondary or symptomatic. The aetiological factors in his essential group are the health of the mother during pregnancy, her previous medical history and habits, position in social scale etc., and also the Constitutional factor of Czerny. The aetiological factors of his symptomatic group are the infections, vomiting, gastro-intestinal infections, and defective feeding. This last factor includes unsatisfactory food, under feeding and over feeding.

Marfan's aetiological factors are (1) Defective food. (2) Affections of the digestive tract and (3) Infections.

This brief resumé of prominent theories will suffice to show that though much useful and suggestive work has been accomplished, there is as yet no uniformity of opinion as to the aetiology and pathogenesis of infantile

atrophy. This applies especially to the cases in which the failure of nutrition has been assigned to faulty proportioning of the energy giving constituents of the food mixture. But there must be additional factors in these cases which decline into marasmus, for on exactly similar feeding, many other infants thrive. Sir William Gower's theory of "ambiotrophy" would seem applicable to such cases. This theory supposes some tissues to be endowed in certain individuals with less than the ordinary share of durability. The Clinical histories of some of these atrophic infants indeed suggest that their function of assimilation is so poorly endowed in staying power that after a few weeks the mechanism fails, and the result is intractable marasmus.

A careful study of the histories of these babies is well worth while, for there are many cases of wasting which are secondary to other causes. These causes may now be briefly summarized.

(1)Improper feeding.

(a) Of Gross nature.

In one of the writer's cases, a baby of 8 months was brought suffering from rickets, tetany, and malnutrition. For five months he had been breast fed. At the end of this period the mother was not satisfied with his progress, weaned the child, and transferred him to a diet of "Bovril and bread, and one bottle of Dr. Ridge's food at night."

(b) Insufficient dilution of cow's milk in the early months of life is a cause which is emphasized by Still.

(c) Giving too much cream in the food mixture. This is a common error, the mother hoping to "strengthen the feed." The excess of fat inhibits digestion, and marasmus may be thus produced in previously healthy infants.

(d) Excess of sugar in the food may in some infants produce flatulence and discomfort, with relaxed

stools, and finally failure of assimilation. Many observers have described marasmus as resulting from feeding upon sweetened condensed milk. The real error here is in the excessive dilution of the condensed milk. A 1 in 8 dilution of Nestlé's milk gives a food mixture with the following approximate composition. Protein 1·2%: Fat 1·2%: Sugar 7%. In spite of its notorious deficiency in vitamins this food is often successful, being easily tolerated by many weakly young infants. If used, however, its vitamin deficiency must be made good from other sources. In hospital practice the harm resulting from this food is due in the first place to the dilutions recommended on the tins being certainly excessive, and in the second place to its deficiency in vitamins.

(e) Similarly wasting may sometimes be seen from excessive dilution of cow's milk, and as in feeding with Nestlé's milk, the association of rickets with the atrophy is invariable.

Irregularity in the intervals of feeding, alike in breast, and in

(f) bottle fed babies, is a fruitful source of digestive disturbance from which wasting may result.

Even with regularity the inter-

(g) vals may be wrong. Too infrequent feeding is very rare, but feeding too often is common: digestion is overtaxed, and marasmus induced.

The use of feeds too large for

(h) the age is a great mistake. A healthy infant, if allowed to do so, always takes too much. The excess is in many cases regurgitated soon afterwards, or vomited. This vomiting is protective. When it does not occur, over feeding commonly produces for the first few weeks a rapid gain in weight. Ultimately however indigestion may occur, and the child then becomes atrophic.

(2) Marasmus resulting from Enteral Infection.

Marasmus often follows a more or less acute gastro-intestinal disturb-

ance of presumably infective origin. There is a history of diarrhœa, sometimes but by no means always, accompanied by vomiting. Such cases are most commonly seen after the prevalence of "summer diarrhoea." The stools are generally green, slimy, and relaxed, containing white pellets of undigested fat or curd. In other cases the stools are simply unduly pale throughout. Emaciation has been progressive, and many foods have probably been tried in a vain attempt to stem the tide of nutritional failure. In one's own cases of this type in which the mothers have given a history of daily vomiting, it has often been noted that after admission to hospital no vomiting occured.
The short preliminary period of starvation frequently imposed, and the initial aperient, are thought to have been responsible for the cessation of the vomiting.

Sometimes these cases are

very resistant to treatment, and it would appear as if the infection of the mucosa had resulted in profound changes in its assimilative capacity. Various observers have described a small cell infiltration of the deeper parts of the mucous membrane giving rise to fibrous replacement of the glandular parts of the mucosa. The resulting cirrhosis if extensive would certainly make absorption impossible, but the cirrhotic change has been described as occurring only in scattered, isolated small areas, leaving ample amounts of apparently efficient absorptive mucosa in the intervening spaces. Other observers attribute these cirrhotic appearances to post-mortem changes, and the vast majority of workers deny that such changes ever occur. Certainly there are no characteristic post-mortem findings in cases of infantile atrophy.

(3) Parental infections giving rise to marasmus.

In some cases of infantile atrophy the wasting has dated

from a definite infective process outside the alimentary tract. Chronic pyelitis is a frequent cause; otitis media is even more common; and severe broncho-pneumonia is often followed by a considerable degree of wasting. Indeed any severe infective process may be followed by failure of nutrition.

(4) Atrophy from Congenital Disease.

Congenital Syphilis is a not uncommon cause of wasting in infancy. It may be associated with well-marked manifestations of Syphilis, and may cease when the accompanying symptoms of syphilis subside. On the other hand, congenital syphilis may manifest itself solely by a progressive marasmus, and in such cases the origin of the wasting is indeed difficult to diagnose, unless suggested by the family history. The pathology of syphilitic marasmus is still sub judice.

Congenital heart disease is invariably accompanied by signs of mal-

nutrition. Still emphasizes the fact that not infrequently the classical signs of cyanosis, and clubbing of the fingers may not appear in congenital heart disease. In such cases the cause of the wasting would escape detection in the absence of a complete examination of the infant.

The congenital debility of premature infants renders them particularly prone to atrophy. Atrophy resulting from difficulty in suction, from pyloric stenosis and other deformities may be mentioned.

Tuberculosis must be noted as a rare cause of infantile marasmus.

G.F. Still calls attention to chronic constipation as a cause of wasting. He finds that it commonly results in failure to gain weight, though in some cases it gives rise to actual wasting: and in any case of marasmus, irrespective of cause, the presence of chronic constipation militates against progress.

(5) Atrophy associated with Deficiency Diseases.

(a) Infantile beri-beri.

This disease, though unknown in Europe in times of peace, causes great infant mortality among rice-eating nations. It is seen in the breast-fed infants of beri-beri mothers, and is due to deficiency of vitamin B in the maternal milk.

The changes at autopsy are identical with those of adult beri-beri.

(b) Infantile Scurvy.

The signs of malnutrition which accompany this disorder rapidly disappear when a sufficiency of vitamin C is given in the infant's food.

(c) Atrophy associated with deficiency of fat - soluble vitamins in the diet.

Rickets and wasting may co-exist in an infant.

In cases of Xerophthalmia

in young children and infants, a disease now known to depend upon a deficiency of vitamin A. in the diet, Bloch has observed that the eye lesion, especially in infants, is often associated with a state of general atrophy. The Xerophthalmia is in some cases complicated by generalised oedema when the children have been fed on excess of carbohydrates, and deprived of all fats. Bloch suggests that lack of fat may itself be the cause of this and other oedemata arising from malnutrition.

Owing to such conflicting of opinions upon the aetiology and pathogenesis of infantile marasmus, the task of classification is formidable. At the present time, general opinion seems to be divided between the views of those who, like Nobécourt and Marfan, adopt a simple clinical classification, and the views of Finkelstein and Czerny, with the adoption of Finkelstein's classification rather than Czerny's.

At this point in the Thesis let us turn aside to consider the vitamin factor in infant nutrition.

III. The rôle of accessory food factors in Nutrition.

Within the last decade our knowledge of the nutritive requirements of the human organism has increased enormously. The old conception that a sufficiency of the basal constituents of the dietary would promote nutrition and growth has been discarded. We now know that nutrition and growth cannot take place on a dietary consisting only of Protein, Fat, Carbohydrate and water in suitable proportions.

In 1881 this suggestion was made for the first time by Lunin, who at that time was investigating the significance of inorganic salts in the nutrition of mice. He observed that when fed on fresh milk, the mice flourished, but soon declined and died when fed on the separated components caseinogen, milk fat, lactose and the milk ash. His

conclusion, that in milk, besides the then recognised essential constituents, there were present other additional substances indispensable for nutrition, aroused little attention.

However, as time passed other observers failed to keep experimental animals alive when feeding them on purified and isolated Protein, fat, carbohydrate and salts. There was general consensus of opinion on that point, though the true explanation which Lunin had visioned in 1881 was lacking. The distinguished German investigator Röhmann did however claim to have satisfied the nutritive requirements of his mice on a diet of isolated and purified food components. Osborne and Mendel have been able to show more recently that Röhmann's results were fallacious, and that complete purification of his food ingredients had not indeed been attained.

In 1906 that inspired British worker F.G.Hopkins, wrote as follows : "No animal can live upon a mixture of pure protein, fat, and carbohydrate, and even when the necessary

inorganic material is carefully supplied the animal still cannot flourish ..... It is certain that there are many minor factors in all diets, of which the body takes account. In diseases such as rickets, and particularly in scurvy, we have had for long years knowledge of a dietetic factor, but though we know how to benefit these conditions empirically the real errors in the diet are to this day quite obscure. They are however certainly of the kind which comprises these qualitative factors that I am considering. Scurvy and rickets are conditions so severe that they force themselves upon our attention, but many other nutritive errors affect the health of individuals to a degree most important to themselves, and some of them depend upon unsuspected dietetic factors."

The work of Stepp in 1911 marked an important advance. He demonstrated then that a diet of wheat bread made with milk was effective for the nutrition of his experimental mice, but after this diet had been subjected to prolonged extraction with alcohol

and ether, it failed to maintain life for more than a month. He found that restoration of this extract to the extracted food restored its original potency in nourishing the mice. This led him to suggest the existence of an unidentified indispensable dietary unit which he appears to have regarded as a member of the lipoid class.

About this time (1911-1912) Casimir Funk was engaged upon a study of Beriberi in the experimental pigeon suffering from the disease through being fed on a diet of polished decorticated rice. He found that to restore health to the bird it was necessary only to restore to the diet an alcoholic extract of these polishings which had been precipitated by phosphotungstic acid. Yeast and certain other foodstuffs he found to contain also a similar curative fraction. To this vital substance he applied the term "Vitamine," later to be differentiated and known as Vitamin B.

Hopkins writing again in 1912 of his continued experiments, gave us information which marked the beginning of a new era in our

understanding of the subject of nutrition and growth. He proved beyond doubt that a diet consisting of completely purified Carbohydrates, Salts, Protein, and lard, even when consumed in quantity more than sufficient for the calorific requirements of his young rats utterly failed to secure growth, and maintain life, but that when a very small addition of fresh milk was made to this basal ration, normal and continued growth occured. A similar growth-stimulating action was exerted by the addition of protein-free, and salt-free extracts of milk solids, or of yeast to the basal diet. He concluded: "It is possible that what is absent from artificial diets and supplied by such addenda as milk and tissue extracts is of the nature of an organic complex (or of complexes) which the animal body cannot synthesize. But the amount which seems sufficient to secure growth is so small that a catalytic or stimulative function seems more likely .... If the attachment of such indispensable functions to specific accessory constituents of diets is foreign to current views upon nutrition, so also is the experimental fact that young animals may fail to grow when they

are absorbing daily a sufficiency of formative material, and energy for the purpose of growth."

The next year (1913) witnessed a further great advance, for then McCollum & Davis discovered that the ether-soluble fraction of butter and eggs contained the growth promoting substance which was lacking from an artificial diet. They showed too, that such a substance was not contained in lard, nor in olive oil. Soon after this (1913) Osborne & Mendel demonstrated that the active substance was concentrated in the butter-fat fraction of the butter.

Further researches, by Osborne & Mendel in 1915, and by McCollum, Simmonds, and Pitz in 1916, demonstrated that this active substance was found in association with several animal fats, such as cod-liver oil, and beef fat, but was absent from a number of oils of vegetable origin.

The ever-zealous worker, Funk, collaborating with Macallum in 1915 reported that rats fed on a basal diet of purified proteins, fats, Carbohydrates and salts to which an addition of butter fat had been made, not only failed to grow, but rapidly declined and died. On the

basis of Funk's vitamin theory of Beri-beri they added a small ration of yeast to the diets, and found that this addition was immediately followed by growth. Unfortunately they disregarded the influence of any substance possibly present in the butter fat, and concluded that "the growth-promoting factor is beyond question contained in the yeast." In consequence, it was left to M^{c}Collum & Davis to clarify the situation, and to these workers belongs the credit of differentiating two distinct accessory food factors. Following upon their careful investigation of the dietary deficiencies of rice, they concluded "that there are necessary for normal nutrition during growth, two classes of unknown accessory substances, one soluble in fats and accompanying them in the process of isolation from certain food-stuffs, and the other soluble in water but apparently not in fats." They termed these two substances "fat-soluble A," and "water-soluble B" respectively, to-day more generally known as vitamins A and B.

From this period rapid strides have been made in investigating the rôle of the

vitamins in nutrition. As a result of research in this field, rickets has been differentiated as a "deficiency disease," due to absence from the diet of the specific anti-rachitic vitamin D., or to lack of sunlight, it having been shown that the ultra-violet rays of the spectrum are capable of elaborating vitamin D from living tissues, the forerunner of this vitamin being apparently cholesterol, or its closely allied compound, phytosterol. Vitamin D. belongs to the fat-soluble class of accessory food factors.

Xerophthalmia in children has been shown to be caused by a deficiency of fat-soluble A factor, and the suggestive studies of M.Mellanby indicate that defective teeth in children may also be a manifestation of deficiency in the diet.

Infantile Scurvy is the manifestation of absence of vitamin C., and beri-beri the result of deficiency of the anti-neuritic factor, vitamin B.

The chemical nature of the vitamins has not yet been revealed, and little is known of their mode of action. It is clear that they occur only in natural food stuffs, and that the human organism is entirely dependent for vitamin supply

upon the food eaten. There is abundant proof that the need for vitamins in the infant and young child is infinitely greater than that of the adult. The importance of realising this cannot be over-estimated.

In considering the question of the supply of vitamins required to ensure normal growth and development of the young animal, the degree of exposure to light is a factor that must be taken into account. Experimental work has shown that normal growth can be obtained and rickets prevented, upon a diet deficient in fat-soluble vitamins if the animal is exposed to sunlight or other forms of light radiation, and that deficiency of calcium and phosphorous compounds in the diet can also be compensated to some degree by similar exposure. A corresponding result has been obtained clinically in infants.

Further, Hume's experimental work with cows suggests that the effect of light may be even more widespread, and that the supply of fat soluble vitamins in the milk of the lactating animal may be dependent not only on the diet of

the mother, but also on the amount of direct sunlight to which she is exposed.

The superiority of mother's milk as a food for infants cannot be ascribed to any one constituent. No small part of it is due to the fact that the mother supplies her young with a food which is both qualitatively and quantitatively adequate as regards protein, fat, carbohydrate, and inorganic salts. But no milk adequate only in these respects would be of any value for growth, and we must therefore ascribe the advantage of mother's milk for the nutrition of infants in part also to the presence of an appropriate supply of the accessory food substances unweakened by heat, oxidation or dilution.

But it is most important to remember that it has been proved experimentally that the mother is dependent upon her own food supply to provide her young with these substances, and should her diet be deficient in this respect they will suffer, sooner or later, in spite of any chemical or tissue sacrifice she may make. The diet of pregnant or nursing women should therefore be one

rich in the accessory food factors, so that their offspring may be supplied with a milk of high value in this respect. Such a diet should include a generous allowance of butter, milk, fresh fruits and leafy vegetables, as well as moderate amounts of meat and eggs: less of the highly refined foods like flour, polished rice, sugar and foods made from these should figure in her dietary. The frequency of rickets in breast-fed infants is sufficient proof that human milk does not ordinarily contain sufficient vitamin D. to afford appreciable protection against this disease. Hand fed infants are even more liable to rickets, since cow's milk varies greatly in its vitamin D. content. It seems justifiable therefore to insist upon the importance of the expectant and nursing mother taking suitable amounts of cod-liver oil as well as giving it to the infant. McCollum and his co-workers have shown that the anti-rachitic vitamin D contained in cod-liver oil passes readily into the maternal milk. The prophylactic exhibition of cod-liver oil in this way, coupled with a rational dietary in pregnancy would soon lessen the present appallingly high incidence of rickets.

It may be said here that the full importance of the rôle of vitamins in nutrition cannot be appreciated unless it be recognized that a deficiency in food, which when complete or extreme leads to actual disease from deprivation, may, when only relative, be responsible for ill-health of a vague but none the less important kind.

At this point in the Thesis personal views upon the aetiology of infantile atrophy will be considered.

IV. Personal views upon Aetiology of Marasmus.

It is significant that the mothers of atrophic infants have always been improperly dieted during pregnancy, for the condition of infantile atrophy may be said to be confined to the poor living under the worst hygienic conditions. Such mothers cannot afford to buy butter, and use in its stead, vegetable margarine deficient in fat-soluble vitamins. Eggs are expensive, and seldom consumed. Good fresh milk is not readily available: tinned milk, deficient in vitamins is commonly used. In short, these mothers have been existing for years

on a diet very poor in vitamins generally, and particularly deficient in the fat-soluble factors. Lack of sunlight in their environment contributes to the deficiencies of their food.

The result is that the breast fed babies of slum mothers exhibit, sooner or later, indubitable evidences of rickets of varying degrees of severity, from slight enlargements of the epiphyseal junctions of the ribs to definite deformities of long bones. Symptoms of bronchial and intestinal catarrh co-exist.

In cases of marasmus, the maternal milk supply has always ceased prematurely, often within a few days or weeks of the infant's birth. It is at least a plausible suggestion that as a consequence of her deficient dietary during pregnancy the mother's own stores of fat-soluble vitamins have been so depleted in supplying the requirements of the foetus that serious hurt to herself is only prevented by Nature inhibiting completely the function of lactation.

In other cases the infant has begun to waste while still on the breast, and

when the amount of maternal milk was apparently adequate. The writer regards this as evidence of deficiency of vitamins in the breast milk, for in such cases as these, analysis has repeatedly shown that the basal constituents are generally present within the limits of normality.

(This explanation is not of course applied to cases of failure of lactation in women who have been adequately nourished during pregnancy. There the inhibition is generally caused by psychical influences. In a neurotic woman, very slight anxiety or worry suffices to inhibit the milk flow.)

It has seemed to the writer that there is a close connection between rickets and Marasmus. Points to be noted are :-

1. Both infantile rickets, and infantile atrophy occur par excellence in babies the mothers of whom have been deficiently fed during pregnancy.
2. Rickets and wasting are very commonly associated in the same infant.

It must be emphasized that the rickety element is apt to be overlooked if not

sought for. Profuse perspiration about the head is not always a striking feature in these cases. Rickety changes in the skull bones may be of very indefinite nature, and in early cases should be diagnosed with caution. As a criterion of the presence of rickets one has placed most reliance upon the so-called "rickety rosary."

In some cases of rickets no deformities of bone may be in evidence, but none the less, rickety changes may be demonstrated by skiagrams.

Deficiency of Vitamin A. (the Growth Factor) and of Vitamin D (The Anti-rachitic Factor) are often associated together. If deficiency of the A. factor is sufficiently marked to inhibit growth, the bony deformities of rickets are never striking, and indeed are characteristically absent.

<u>But there is no reason to suppose that the catarrhal symptoms of rickets may not manifest themselves before definite changes of bone have had time to take place</u>. Catarrh of mucous membranes, especially of the respiratory and alimentary tracts is typical of rickets. Parenteral catarrhs are common in marasmus: and as for catarrh of the intestinal tract, it is the most

striking feature of infantile atrophy. Abnormality of stools, and a tendency to either constipation or diarrhœa are features then common to both rickets and marasmus.

It is therefore submitted in this Thesis that in cases of Atrophy in Infants, the initial symptoms of indigestion may be due to intestinal catarrh of rachitic origin dependent upon a relative deficiency of Vitamin D., commencing in intra-uterine life, and continued while the infant is still fed on the maternal milk.

The following hypothesis is suggested.

The digestive derangement at this stage is purely functional, but interferes with assimilation, and atrophy commences. The infant's food is now commonly altered in an effort to stem the tide of nutritional failure. Frequently the alteration made is the prescription of a food mixture with low fat and relatively high carbohydrate content. If the writer's theory be correct, this prescription is calculated to aggravate the pathological condition. The deficiency of fat with its inevitably feeble anti-rachitic potency

will encourage an exacerbation of the intestinal catarrh, and the high sugar content of the food mixture may similarly tend to increase the out-pouring of glairy intestinal mucus..

The catarrhal condition of the bowel favours infection, which may be super-added at any stage. The syndrome then resulting would appear similar to Finkelstein's Food Intoxication Syndrome.

Even in the absence of enteral infection, the aggravation of the intestinal catarrh by the progressing rickets may so interfere with assimilation that the infant slowly dies of inanition - the state of Decomposition.

If this theory is correct, the exhibition of anti-rachitic vitamin in the form of cod-liver oil might be expected to produce rapid improvement, and recovery.

In mild cases, and in early cases such therapy will probably quickly succeed. But if the case is one with severe functional digestive derangement, immediate response to vitamin replacement can hardly be expected. Some degree of

normality of intestinal function must first be restored. In the worst cases response to treatment may be impossible, owing to the severity of the nutritional disturbance previously induced.

This deficiency of fat-soluble vitamins in the mother's diet will hereinafter be referred to as the "Factor of Deficiency" in the production of Atrophy. It will be understood that a deficiency of anti-rachitic vitamin is specially implied.

Within narrow limits all slum babies are affected by this factor of deficiency to the same degree. Why then do some only, and not all become atrophic?

A slum baby who happens to be fortunate in his heredity is endowed with a strong vital impulse, and good digestive capacity. A degree of intestinal catarrh does not seriously inhibit the digestive power of such an infant, and if secondary infection - enteral or parenteral, is not superadded, no very obvious malnutrition will ensue. On the other hand, ill-health of one or other of the parents - especially of the mother, will result in an inferior constitutional inheri-

tance for the child. Such an infant is a most delicate metabolic machine, and when the factor of deficiency has induced catarrhal manifestations of rickets in the intestinal tract, indigestion, and failure of assimilation will rapidly follow. The more marked the degree of inferior constitutional inheritance, the more marked will be the metabolic disturbance, and the worse will be the prognosis. The presence of this "Factor of Inferior Constitutional Inheritance" is regarded as essential to the production of Idiopathic atrophy.

Even when the slum child is fortunate in his heredity, and is endowed in intra-uterine life with a strong vital impulse, he is still exposed to danger. The factor of deficiency is always present, and the more marked this has been, the more susceptible to infection will be the child. In his post-natal environment the liability to infection is often overwhelming. When the factor of inferior constitutional inheritance is also present, infection is almost certain. The baby is invariably supplied with a dirty "dummy" or "artificial teat", and the feeding bottle is often uncleanly. The factor of deficiency having

already induced intestinal catarrh, an enteral infection may now be superadded, and wasting occur, accompanied by symptoms of gross intestinal disturbance. Or a parenteral infection may be sustained at any time, and initiate the onset of atrophy.

Secondary Infection is then the third great aetiological factor in the production of infantile atrophy.

Insufficient Sunlight and fresh air, and improper nursing may be grouped along with Improper feeding. These constitute the fourth aetiological factor - the "Factor of Faulty Hygiene." Either of the components may predominate.

It will be apparent that in any case of infantile atrophy all of these factors may be present. The factor of deficiency, is never, and the factor of faulty hygiene probably never, absent.

One believes that idiopathic or primary atrophy is the result of the combination of these latter two factors allied to the presence of the factor of inferior constitutional inheritance.

In some cases of infantile atrophy

the factor of inferior constitutional inheritance is strongly in evidence, as for example in congenital syphilis, congenital heart disease, or prematurity. In others it may be inferred from a history of tuberculosis in one or other parent, or again by a history of failure to rear successfully other children of the family. The influence of the factor is always one of relative degree.

The next Section of this Thesis is devoted to personal case records. The first series contains ten cases. These infants were under the writer's care during the first half of 1926 when he was Senior House Physician at Queen Mary's Hospital for the East End, Stratford, E. 15.

For permission to publish these clinical notes he is indebted to Dr. G.A.Troup, Dr. Gordon Lane, and Dr. Arthur A. Osman, Hon. Physicians to the Hospital.

The 10 cases in Series II were observed during the past winter at the Holborn and Finsbury Hospital, Archway Road, London, N. 19. The clinical material in this series has come from the slum districts of Central London. The writer wishes to express here his sincere thanks to Thomas Evans M.D. (Edin.) D.P.H., Medical Superintendent of the Hospital, for much kindness in granting special facilities for the observation of the cases, and for permitting the treatment adopted.

V.

Record of Cases personally treated.

1st. Series: from Queen Mary's Hospital for the East End. London. E. 15.

Case I. Geoffrey M. Aet, 8 months: admitted 2.1.26.

History:

Baby one of twins from first pregnancy. Born at term. Forceps delivery. At birth had facial paralysis, which passed off inside one week. Child breast fed for 5 months, but as he was beginning to waste, mother transferred him to a diet of "Bovril and bread and one bottle of Dr. Ridge's Food at night." Recently getting very thin. Stools very offensive - mustard colour. Bowels open twice daily. Mother's chief anxiety is that "baby's hands are very strange."

Family History: Father and Mother both well.

The twin brother of this infant, who has been similarly fed, is said to be perfectly well.

No tuberculosis in family.

Examination.

Child very fretful. Typical head of rickets. Advanced rickets in thorax.

Muscles very flabby. Hands in accoucheur's position: carpopedal spasm marked. Tongue clean: Throat natural: Nasal and bronchial catarrh very marked. Protuberant abdomen. Child is definitely wasted. Weight 13 lbs. 8 oz.

On admission the lower bowel was washed out with warm water, after which a small water enema containing Chloral Hydrate and Pot. Brom. of each grains 5 was instilled P.R. Ol. Riein, 3 drachms was immediately given by the mouth, and calcium chloride grains 15 t.d.s. prescribed to be taken for 4 days.

After 6 hours' preliminary starvation, 6 oz. of whole milk containing 6 grains of sodium citrate was taken every four hours. Between feeds ten drops of pure cod liver oil were taken. In addition the infant had ultra violet light therapy.

Abstracts from progress notes.

4.1.26. Manifestations of tetany have passed off. Child is quite happy. Bowels open -

three times yesterday, and once this morning. Offensive relaxed stools. To have Hyd. c. cret : gr. ½ t.d.s. for 4 days. Taking feeds well.

12.1.26. Baby contented. No further symptoms of nervous instability. No gain in weight. Stools normal this morning.

16.1.26. Weight stationary since admission. General condition better. Takes feeds well. Smiles readily.
Stools offensive again.

18.1.26. Gained 2 oz.

22.1.26 Gained further 4 oz. Baby quite happy.

6.2.26 Gained 1 lb 7 oz. since admission. Weight rising steadily now. No signs of nervous instability. Baby is contented. No physical signs in chest. Abdomen is less protuberant. Discharged to M.O.P.D. for treatment of Rickets.

Remarks.

The case is quoted as an example of grossly improper feeding. The element of wasting was only moderate in comparison with the prominence of the rickets and Tetany. The latter responded

rapidly to treatment. This child was weighed every two days, and for the first fortnight the weight was absolutely stationary. After this the weight chart was normal.

The patient's twin brother was brought to the hospital for inspection. He was suffering from advanced rickets. Both twins improved very markedly under cod-liver oil, and ultra violet light therapy in the Medical Out-patient Dept. One was able to observe them for 6 months.

Aetiological Factors present in case.

(1) Factor of Deficiency marked. Loss of weight had commenced while still on breast milk.

(2) Constitutional Factor absent. Family history apparently good.

(3) Hygienic Factor. Present. Very great errors of feeding.

Case II.

Elsie M. aet. 3 months. Admitted on 4.1.26.

History

1st child of family. Born at term: weight 5¾ lbs. Easy normal labour. Baby breast fed for 10 days. Then lactation ceased. Was taken to Infant Welfare Clinic;

and dried milk prescribed. Progressed normally for 4 weeks, when baby got Pneumonia. Treated in Whipp's Cross Hospital for 4 weeks. On return home, was fed on mixture of milk and barley water every 3 hours. Seemed to be all right until yesterday, when diarrhœa and vomiting started.

Family History.

No tuberculosis in family. Father healthy. Mother felt very run-down during pregnancy, and thinks that is why her milk failed. Feels much better now. Mother is anaemic.

Examination.

Baby very wasted and feeble. Fontanelle sunken. Well-marked head retraction. No ear discharge. Definite "rickety rosary" Lungs clear: Heart natural: Abdomen very protuberant. Throat natural: Tongue, slight fur.

Central Nervous System. Attempt at ophthalmoscopic examination unsuccessful. All reflexes

natural.

Temperature is 103°. Weight 7½ lbs.

Treatment.

Owing to the collapsed state of the infant, the risk of a preliminary period of starvation was not taken. Two ounce feeds of Nestlé's milk were given every two hours.

On admission the lower bowel was irrigated with saline, and this was repeated night and morning for one week. During the period of collapse, hypodermic injections of strychnine and ether were given every four hours. On the evening of admission, one drachm of ol. Ricin was given. To supply the deficiency of anti-scorbutic vitamin in Nestlé's milk the baby had one teaspoonful of orange juice night and morning.

While the infant was being fed every two hours, doses of two drops of Ol. Morrhui were given between feeds.

Progress Notes.

5.1.26. Baby very weak, but taking its feeds. Last night temperature was 105°. Subnormal

this morning. Head still retracted. No ear discharge. Offensive green, relaxed, stools.

6.1.26. Pulse "running". Child very low. Still taking its feeds. Four green stools in last twenty-four hours. No vomiting since admission. No ear discharge. Head retraction is less marked this morning.

7.1.26. Baby looks a trifle better this morning. No head retraction: no ear discharge has been seen. Stools yellow, with much mucous. Three motions in last 24 hours.

8.1.26. Baby's expression much better to-day. Quite peaceful. No gain in weight. Since admission temperature has been irregular; subnormal in mornings, with evening elevations. General downward tendency of evening temperature. No gain in weight. Saline irrigations of bowel have been continued since admission. Rectal saline for retention given yesterday was retained. Repeat rectal saline to-day. Taking feeds very well.

11.1.26. Now apyrexial. Gained 5 oz. since admission. Stools normal to-day. Two motions in twenty-four hours. Baby smiles now.

Discontinue rectal irrigations. Fluid returns clear. Takes feeds well. Looking much better.

16.1.26. Weight still at 8 lbs. Give 2½ oz. feeds of Nestlé's milk every 3 hours. Baby feeble and not very interested in surroundings. Smiles occasionally. Give Ol. Morr. 3 drops, between feeds.

23.1.26. Weight slowly rising now. Everything going well. Stools vary in character: often green.

6.2.26. Gaining weight. Looks better. Increase feed to 3 oz. every three hours. Character of stools variable. Bowels open b.d.s.

13.2.26. Losing weight. No vomiting: chest clear: abdomen rather protuberant: soft. Baby seems contented. No ear discharge. To have ultra violet light therapy.

18.2.26. Baby improved again. Sister thinks light treatment is responsible. Change feed to milk 2 parts, water 1 part, lactose one drachm in each feed of 4 oz.

1.3.26. Continued improvement. Gaining quickly now.

8.3.26. Weight now 10 lbs. 2 oz.

10.3.26. Discharged. To attend M.O.P.D. for anti-rachitic treatment.

Weight Chart.

Date	Weight
5.1.26.	7½ lbs.
9.1.26.	7 lbs. 10 oz.
11.1.26.	7 " 12 "
13.1.26.	7 " 14 "
14.1.26.	8. " 0 "
17.1.26.	8 " 0 "
18.1.26.	8 " 2 "
24.1.26.	8 " 4 "
30.1.26	8 " 8 "
4.2.26.	9 " 4 "
7.2.26.	9 " 6 "
9.2.26.	9 " 2 "
12.2.26.	9 " 0 "
16.2.26.	9 " 0 "
18.2.26.	9 " 2 "
25.2.26.	9 " 4 "
1.3.26.	9 " 8 "
8.3.26.	10 " 2 "
10.3.26.	10 " 4 ".

R e m a r k s.

This baby presented the clinical syndrome of Food Intoxication, but recovery was good on a mixture rich in sugar, and poor in fat. (Nestlé's Milk).

The baby showed indubitable evidence of rickets. The head retraction was presumably due to catarrh of the middle ear, without external discharge.

Aetiological factors.

(1) Factor of Deficiency - strongly marked.

(2) Secondary enteral infection

(3) Factor of Faulty Hygiene.

Case III. Ronald P. aet. 10 weeks. Admitted on 8.1.26.

History 1st child.

At birth child weighed 10½ lbs. Mother states there was no milk in her breasts, and baby was bottle fed from birth. For first 14 days was on Nestlé's Milk: "did not do on it." "Glaxo"was substituted, but baby was very constipated, so cow's milk and barley water was tried; this was vomited. Next "Almata" was given, and suited the baby. Had been having this for five weeks, and was thriving until five days ago, when diarrhœa and vomiting started. Said to have vomited daily since then. Stools green, watery and offensive: Six motions in last twenty-four hours. Mother says rectum has been coming down. Baby has been gradually losing weight.

Family History.

Father said to be a healthy man. Mother felt very tired towards latter end of pregnancy. Says she does not feel well now, and attributes this to worrying about the

baby. No tuberculosis in family.

Examination. Baby has obviously lost weight. Skin inelastic. Child apathetic. No signs of organic disease. No prolapse of rectum. P.R. examination negative. Temperature 97·8°. Weight on admission 9 lbs 6 ozs.

Treatment.

Child was given two drachms of Ol.Ricin on admission, and starved for 12 hours: boiled water given ad. lib during this period. At the end of the period of starvation skimmed milk was given - 2 oz. every 2 hours.

Progress notes.

18.1.26. Has lost 2 oz. since admission. Child is fretful. Stools green.

20.1.26. Gained 2 oz. Change feed to Half-cream Glaxo, 2 oz. every 2 hours.

26.1.26 Baby looks better. Stools still relaxed, but better than on admission. Give 2 drops Ol. Morr. between each feed.

29.1.26. Taking feeds well. Seems brighter. Stools alternate between green and yellow. No diarrhœa. Has gained 2 oz.

4.2.26. Weight again as on admission. Stop

Glaxo: give milk and water, of each equal parts in 3 oz. feed every 3 hours. Continue ol. Morr.

11.2.26. Gained 1 oz. Baby smiled this morning. Give milk 3 parts, water 1 part, lactose 1 drachm in feed of 3 oz. every 3 hours.

15.2.26. Baby is certainly better, and much brighter. Stools alternate between green and yellow. Has gained weight.

20.2.26. Improvement maintained. Everything going well. Gained weight.

27.2.26. Continuous improvement. Increase feed to 3½ oz. every 3 hours.

7.3.26. Stools normal: steadily gaining weight.

23.3.26. Baby happy and perfectly well. Discharged.

Weight Chart.

Date	lbs.	oz.
8.1.26.	9.	6.
11.1.26.	9.	8.
15.1.26.	9.	6.
18.1.26.	9.	6.
22.1.26.	9.	8.
25.1.26.	9.	8.
27.1.26.	9.	10.
3.2.26.	9.	4.
4.2.26.	9.	6.
6.2.26.	9.	7.
12. 2.26.	9.	8.
15.2.26.	9.	14.
18.2.26.	9.	15.
23.2.26.	10.	1.
1.3.26.	10.	5.
4.3.26.	10.	6.
11.3.26.	10.	10.
15.3.26.	10.	15.
18.3.26.	11.	0.
22.3.26.	11.	3.

Remarks.

The weight at birth (10½ lbs) of this baby suggests that it was very well nourished in utero. But the mother had no breast milk when the baby was born. This is taken as evidence that her vitamin stores had been utterly depleted during pregnancy.

Aetiological factors in case

(1) Factor of deficiency

(2) Secondary enteral infection.

(3) Factor of Faulty Hygiene.

Case IV. Irene H. aet. 5 months. Admitted 25.2.26.

History. An only child. Born at term: weight at birth 6½ lbs. Breast fed for 3 weeks. Did not thrive, and after 3 weeks, lactation ceased. Since then baby has been tried on 7 different patent foods! No food seems to agree. Baby has vomited off and on since birth. Stools always offensive, and generally constipated. Baby is wasting.

Family History.

No family history of Tuberculosis or acute Rheumatism. Mother is anaemic: looks tired: says she feels quite well. Father reported to be a healthy man.

Examination.

Typical marasmic infant. Definite "rickety rosary". Otherwise, no physical signs of disease. Baby very feeble.

Progress notes.

1.3.26. No vomiting since admission. Sleeps well. Takes feeds well: is having milk 3 parts, water 2 parts, lactose 1 drachm in feed of 3 oz. every 3 hours. Taking 5 drops of pure ol. Morrhui between feeds.

12.3.26. Vomited twice to-day. Has a slight cough. Temperature was 100° last night. Crepitations both bases. Child fretful. Stools green and relaxed. Temperature 97.4°. Has gained 3 oz. No signs of oedema. Give ol. Ricin, drachms 2.

15.3.26. Persistent vomiting. Diarrhœa present. Child apathetic, and seems lifeless. Colon lavage ordered, and subcutaneous saline given. To have albumin water only for 24 hours.

16.3.26. Diarrhœa persists and child is becoming dehydrated. Repeat subcutaneous salines. Has not vomited the albumin water. Temperature is only 96°. Baby very low. Add dextri-maltose to albumin water. Give 10 drops brandy every 4 hours.

18.3.26. Vomiting everything, even sips of water. Profuse diarrhoea. Baby is stuporose and utterly exhausted. Is having subcutaneous salines, and injections of camphor and ether. Temperature still 96°.

19.3.26. Died. Parents refused P.M.

Remarks.

Clinically this case was one of "Food Intoxication". The fact that the baby had never thrived from birth, and that so many different foods had been tried in vain before admission to hospital suggests that this infant was the victim of inferior constitutional inheritance.

On admission to hospital there was an apparent improvement for two weeks. Then evidently an acute enteral infection supervened.

In this case the aetiological factors are considered to have been :-

(1) Factor of deficiency

(2) Factor of inferior constitutional inheritance

(3) Secondary enteral infection.

(4) Factor of Faulty Hygiene.

Case V. Thomas B. aet 4½ months. Admitted 8.3.26.

History 1st baby.

Born at term after difficult labour (chloroform and forceps). Weight at birth 6 lbs. Breast fed every 3 hours, and did well for 4 weeks. Then began to waste slightly. No vomiting: no diarrhœa. As wasting continued, baby was taken to Infant Welfare Centre at age of 6 weeks. There mother was advised to take him off breast, and give "Ambrosia" every 3 hours. Baby improved at once, and by age of 3 months weighed over 9 lbs.

When 3 months old, got "eczema of head", and was taken to Great Ormond Street Children's Hospital, and admitted. On discharge from hospital two weeks later scalp was healthy again, and the child has since been fed on "Cow & Gate". Baby takes his feeds well, but he has never progressed since he had the first scalp infection at 3 months. Has been very listless since leaving Great Ormond Street. One week after return home "eczema" of scalp returned - Bowels have always been constipated. Weight has been slowly falling.

Family History.

Mother is a pale, unhealthy-looking young woman. Says she did not feel well towards latter end of pregnancy, and was getting thinner. Felt much better after weaning baby. No previous pregnancies. Father accompanies Mother. He is of plethoric type, and says he is quite well.

Examination.

A wasted baby with a definite rickety rosary. Moist dermatitis affecting entire scalp. No septic spots elsewhere. Occipital glands swollen. Infant very listless and limp. Does not resent examination. Discharge from right ear. Heart and lungs apparently healthy. Abdomen slightly protuberant.

Treatment.

On admission, was given 2 drachms of ol. Ricin. Starch poultices were prescribed for scalp. The food mixture ordered was milk and water equal parts, with lactose one drachm in 3 oz. feeds every 3 hours.

Progress notes.

14.3.26. Child takes feeds greedily, and always seems hungry. Face is unusually white. No vomiting. Stools are green and offensive. Bowels open three times daily. Is having 5 drops of ol. Morrhui between feeds. Scalp condition is little changed. Baby does not smile, but is not fretful.

21.3.26. Scalp very septic. Baby is listless and apathetic. To have ultra violet light treatment . No vomiting. Stools vary. Are now often pale and soapy.

27.3.26. Weight stationary. Scalp condition improved. Stools green. Temperature sub-normal since admission. Gen. condition of baby very poor.

5.4.26. Lost 4 oz. this week. Stools pale, dry, and crumbly. Scalp condition a little better. Does not smile. Very white and feeble. Give 2 oz. feeds every 2 hours.

12.4.26. Scalp condition fluctuates in severity. Baby always seems ravenously hungry. Stools alternate between green and pale, but are more commonly pale, dry, and crumbly recently.

Temperature always subnormal. No physical signs in lungs.

15.4.26. Baby has developed oedema. Very marked in feet and backs of hands. Does not seem to be generalised. Crepitations both bases. Baby sleeps very little. Very apathetic. Never smiles. Give Hyd. ć Cret. gr.¼ t.d.s.

20.4.26. Oedema gone. Seems a little brighter. Still taking feeds greedily. Change feed to Mead's.

24.4.26. No vomiting. Is always hungry, and takes feeds well. No improvement in general condition. Oedema comes and goes from day to day. Always seems to be confined to feet and backs of hands. Stools light and crumbly: not offensive. Scalp condition fluctuates in its severity.

27.4.26. Died quite suddenly yesterday evening - The parents were visiting the baby, by chance only, as death was not expected - The baby's mother noticed the child had stopped breathing. Immediately before, it had seemed to be in a natural sleep.

Weight chart.

Date	lbs.	oz.
8.3.26.	9.	8.
14.3.26.	9.	6.
21.3.26.	9.	6.
28.3.26.	9.	6.
5.4.26.	9.	2.
12.4.26.	9.	3.
19.4.26.	9.	7.
26.4.26.	9.	1.

Remarks.

Clinically the progress of this infant was typical of intractable decomposition. The danger of sudden death in marasmus is illustrated in this case.
One considers the case to belong to the Primary Idiopathic Group in which the aetiological factors are:-

(1) Inferior Constitutional inheritance, and

(2) The factor of deficiency
Superimposed Secondary infection was here illustrated by the otorrhœa, and skin manifestations.

(3) Factor of Faulty Hygiene.

Case VI.

Margaret K. aet. 3 weeks.

Transferred from Midwifery Dept. 27.3.26.

History

1st child. Mother had eclampsia, and was delivered three weeks ago in Midwifery Dept. of this hospital. Baby was premature, only 7 months. Very blue at birth: cyanosis soon passed off. At birth weighed only 3 lbs. 4 oz. Has been fed on half cream Glaxo since birth. Stools have never been yellow - always brown. Baby is now passing bright red blood. No vomiting.

Examination.

A tiny emaciated creature. Heart sounds are natural. Lungs clear. Nothing abnormal detected in abdomen. No signs of any haemorrhages in skin. No signs of congenital syphilis. Baby is very collapsed. Temperature is 96·5°.

Treatment.

5 cc. of fresh blood from universal donor injected, immediately after withdrawal from forearm, into buttock of infant. Given 1.30 p.m. Injection repeated at 5 p.m. Mellin's Food prescribed.

Progress notes.

28.3.26. Baby vomited after 9 o'clock feed. Still passing bright blood P.R. Intra muscular injection of whole blood repeated.

30.3.26. Now on Sherry Whey. Not vomiting. Pulse "running." Infant quite collapsed. There has been no further frank haemorrhage. Small dark brown stools - three in last 24 hours. Temperature is 96°. Has had two subcutaneous salines.

31.3.26. Died.

Remarks.

The mother of this infant subsequently attended the M.O.P.D. of the hospital. Her Wassermann was negative. She had severe symptoms of chronic Interstitial Nephritis.

A haemorrhagic tendency may be associated with either Congenital Syphilis or Congenital Heart Disease, but the infant showed no evidence of either, and was accordingly labelled "Melaena Neonatorum." The history of brown stools suggests that the haemorrhage began just after birth. The infant was premature - only 7 months.

The case was one of Primary Atrophy and the aetiological factors present were :-

(1) Factor of Deficiency.

(2) Factor of inferior physical and constitutional inheritance.

(3) Further debility from loss of blood.

Case VII. Albert F. aet. 4 months. Admitted 30.4.26.

History.

1st. child of family. Born at term. Weight 6 lbs. For first two weeks infant was fed on the breast, and did well. Then lactation ceased. Baby was at once taken to Welfare Centre; there dried milk was prescribed. Has had no vomiting. Stools are green and frequent. Mother says child has been wasting rapidly - "falling away" for last three weeks, and during this time there has also been a troublesome cough.

Family History.

Father said to be healthy.

Mother is very untidy, very anaemic, and looks to be in poor health. Says she has "never been very strong."

No family history of Tuberculosis.

Examination.

Infant is emaciated, neglected, and dirty. Buttocks and Penis affected with a moist dermatitis: very large sore on left buttock. Abdomen protuberant. Weight 7 lbs. 4 oz. No bony evidences of rickets. Heart: strong pure sounds: lungs, basal crepitations -

Treatment.

Warm alkaline baths t.d.s. were prescribed, and Unq. Zinci for the dermatitis. The food prescribed was Milk and water, equal parts, with dextri maltose and cream, of each one drachm in feed of 3 oz. to be taken every 3 hours. The infant was also given one drachm of Ol. Ricin upon admission. Temperature then was 100·2°: Respirations, 48: Pulse Rate 160.

Progress notes.

2.5.26. Baby is extremely feeble. Temperature is normal. Taking feeds fairly well. Stools relaxed and green. No cyanosis. Scattered crepitations at both bases.

3.5.26. Child is very feeble. Seems about the same as on admission. Has taken all of feeds. No vomiting. Temperature is 97·2°.

4.5.26. Child had a sudden convulsive seizure last night about 11 p.m., and died almost at once.

Remarks.

The danger of sudden death in marasmus is again illustrated. It is thought that the child probably had broncho-pneumonia, though the physical signs in the lungs were indefinite.
Enteral infection may have been present.
Parenteral (Skin) infection was marked.

The aetiological factors present in the case were :-

(1) Factor of Deficiency
(2) Inferior constitutional inheritance. Mother's health was unsatisfactory.
(3) Secondary infection.
(4) Factor of Faulty Hygiene.

Case VIII.

Ivan H. Aet. 2 months. Admitted 11.5.26.

History 2nd child of family.

At birth child weighed 7 lbs. 2 oz. Easy normal labour. Breast fed for one week. Then lactation ceased. Baby was then given "Glaxo," but did not progress, and "Cow & Gate" was substituted. There has been no vomiting. Baby has always been inclined to constipation. He has gradually wasted from birth.

Family History.

No family history of Tuberculosis.

One other child 18 months old. This baby was breast fed, and is healthy.

Mother is anaemic, and badly nourished. The father is out of work: said to be healthy.

Examination. Typical marasmic infant. Weight only 6 lbs. 4 oz. Heart natural: Lungs: no physical signs: abdomen protuberant. Very fretful.

Treatment: On admission given two drachms of castor oil. After period of six hours without food, to have Milk and water of each 1 oz., with lactose one drachm every three hours.

Progress Notes.

13.5.26. Infant seems about the same. Takes feeds well. No vomiting. Stools formed and green. Bowels open three times in twenty-four hours.

21.5.26. Gained 4 oz. in weight. General condition seems a little better.

26.5.26. Improving. Gaining weight.

3.6.26. Still taking feeds well, but has lost weight. Child is fretful. No physical signs in chest. No evidence of colic. Stools of normal colour, but contain large cheese-like particles. Bowels open twice in the twenty-four hours. To have ultra violet light treatment.

6.6.26. Has a slight cough. A few scattered rhonchi in chest. Temperature 99·6°. Previously temperature has been sub-normal since admission.

10.6.26. Chest condition unaltered. Baby is brighter this morning.

13.6.26. Chest clear. Infant has gained 14 oz. since admission. Very feeble infant.

20.6.26. Gaining weight slowly. Give milk 3 parts, water one part, lactose one drachm in

feed of 2½ oz. every 3 hours.

22.6.26. Septic spots on legs and back of neck. Reported to have cried a good deal during the night. Baby very limp this morning. Change feed to Nestlé's Milk and give four drops Ol. Morrhui between feeds, and orange juice night and morning.

23.6.26. Free discharge of pus from many small abscesses. Child feeds greedily. Not apparently distressed. General condition very poor. Apyrexial. Has lost weight. Stools dry and crumbly.

28.6.26. Dermatitis clearing up. Child seems better. Smiled again this morning.

3.7.26. Improving. Baby much brighter.

10.7.26. No dermatitis. Great improvement in general condition. Gaining weight.

21.7.26. Weight 9 lbs. 11 oz. Baby is perfectly well. Discharged.

Weight Chart.

Date	lbs.	oz.
11.5.26.	6.	4.
21.5.26.	6.	8.
26.5.26.	7.	6.
3.6.26.	6.	14.
6.6.26.	7.	0.
10.6.26.	7.	0.
13.6.26.	7.	2.
20.6.26.	7.	6.
23.6.26.	7.	4.
28.6.26.	7.	5.
1.7.26.	7.	9.
8.7.26.	8.	0.
12.7.26.	8.	6.
16.7.26.	9.	3.
18.7.26.	9.	8.
21.7.26.	9.	11.

This case is regarded as one of Primary Atrophy.

Wasting dated from birth.

Aetiological Factors.

(1) Factor of Deficiency. Very marked.

(2) Probably a degree of constitutional weakness.
Not marked.

(3) Secondary parenteral infection.
(4) Factor of Faulty Hygiene.

The response to treatment was good.

Case IX. John D. Aet. 1 month. admitted 31.5.26.

History.

Born prematurely at 7½ months. Weight at birth not known. Easy labour. Breast fed every 3 hours till admission. Has lost weight steadily since birth. Stools are green. There has been no vomiting.

Family History.

No Tuberculosis on either side of family.
Father said to be healthy.
Mother was in poor health during pregnancy and suffered from severe morning sickness.
Is now very pale and says she has "no energy".
This baby is her first child.

Examination.

An emaciated infant weighing only 4 lbs. 4oz. No physical signs in chest. Abdomen is slightly protuberant. Baby seems quite lifeless. Fontanelle sunken. Temperature sub-normal.

Treatment. Nestlé's Milk to be given every two hours. 1 oz. feeds. Orange juice to be given night and morning and two drops of ol. Morrhui mid-way between bottles.

Progress Notes.

2.6.26. Baby extremely feeble. No vomiting. Has gained 2 oz.

3.6.26. Gained a further 2 oz. No signs of oedema. General condition is very poor. Two green stools in last twenty-four hours. Not taking feeds well. Circulation very feeble. Crepitations both bases. No signs of oedema. No vomiting.

4.6.26. Circulation failing. Pulse "running" and just perceptible. Fontanelle very sunken. Baby lies quite still and is collapsed. Given rectal saline containing glucose and brandy. Enema retained. No improvement in baby.

5.6.26. Crepitations both lungs. No vomiting. Stools relaxed and green. Baby is on four-hourly injections of camphor, strychnine, and ether.

7.6.26. Temperature has been sub-normal since admission. For last two days has been only 96^{o}. Is having rectal salines with glucose.

8.6.26. Died.

Remarks.

The baby is thought to have died of Broncho-pneumonia. Obviously the gain in weight was due to oedema, though no oedema was demonstrable clinically. The prematurity of the infant militated against its chances of life. In this case the aetiological factors were

(1) Factor of deficiency.

(2) Inferior constitutional inheritance

(3) Secondary infection.

(4) Factor of Faulty Hygiene.

Case X. Muriel S. Aet. 6 weeks. admitted 25.5.26.

History.

Full term child. Normal labour. Weight at birth 7 lbs. 6 oz. Breast fed every 3 hours. Baby has been gradually wasting since birth. Cries a good deal. Stools have always been green and slimy. Never any vomiting. Mother thinks her milk is poor.

Family History.

Father; stated to be strong and healthy.

Mother: Has had no serious illnesses. Looks tired and anaemic. Says she never has much energy. This infant is her second child. First baby still-born 2½ years ago after Breech delivery. No miscarriages. No tuberculosis on either side of family.

Examination.

Small marasmic infant. Weight only 6 lbs. 2 oz. No physical signs of disease. Temperature 97.8°.

Treatment.

Boiled water only for 6 hours. One drachm of Ol. Ricin given on admission. Food: Nestlé's Milk 1½ oz. every 3 hours - Cod liver oil, 3 drops; given half-way between bottles (i.e.

6 doses daily). Orange juice: one drachm given night and morning.

Progress Notes.

Temperature remained sub-normal throughout. Pulse and Respiration rates were always natural.

28.5.26. Child less fretful. Stools rather relaxed and green.

30.5.26. Condition so far very satisfactory. Stools are improving. Takes feeds well. No vomiting. Looking better.

8.6.26. Everything going well. Gaining weight. Baby smiles and is quite bright. Stools normal.

15.6.26. Improving steadily in every way.

22.6.26. Very great improvement. Gaining weight steadily.

29.6.26. Discharged. Baby well, and perfectly happy.

Weight Chart.

Date	lbs.	oz.
25.5.26.	6.	2.
29.5.26.	6.	4.
2.6.26.	7.	0.
7.6.26.	7.	5.
11.6.26.	7.	8.
17.6.26.	7.	10.
22.6.26.	8.	0.
25.6.26.	8.	2.
28.6.26.	8.	5.

Remarks.

In view of the fact that this baby was wasting steadily upon breast feeding, and responded so rapidly to hand feeding, one infers that the factor of deficiency was particularly well marked in this case. The stools were "always green and slimy" when on the breast. This indicates a catarrhal state of the bowel, which on the writer's theory, was the first manifestation of the development of rickets through deficiency of Vitamin D in the mother's food, and consecutively in her milk.

At the time this case was treated the conception of infantile atrophy as a manifesta-

tion of existing rickets had not occurred to the writer. The cod liver oil in the treatment of this baby was simply used as a prophylactic measure, owing to Nestlé's Milk having been chosen for the food.

One now believes that the cod liver oil acted here as a specific curative agent. The intestinal catarrh quickly improved since the disease was subjected to early treatment. Assimilation was improved at once, and the gain in weight correspondingly rapid.

The cases which follow are those of the 2nd. Series studied at the Holborn and Finsbury Hospital, London, N. 19.

2nd Series of Cases: from Holborn and Finsbury Hospital, London, N. 19.

Case I. Sarah Joan F---H. aet. 2½ months.

Admitted to Ward I on 2.12.26.

History.

Baby one of twins born at term in University College Hospital. (2nd twin was born dead) Weight at birth 5 lbs. 6 oz. Has been breast fed since birth every 3 hours. Progressed satisfactorily until one week before admission when diarrhœa and vomiting began. Previously was well.

Family History.

No tuberculosis on either side of family.

Father is "strong and healthy".

Mother is a tired pale woman of 30. (looks much older) She has had no serious illnesses in the past, and her health during pregnancy was good. There are five other children in the family (including twins from 1st pregnancy). All are well, and all were breast fed. No deaths and No miscarriages.

Examination.

A badly nourished infant. Weight 8 lbs. 4oz. Definite "rickety rosary" present. Child very fretful. Moist sounds in both lungs. Child has cough. Heart natural. Abdomen soft: slightly protuberant. Throat natural.

6.12.26. Child has a spasmodic cough. Crepitations at both bases. Is having "Cow & Gate", 2 oz. every 3 hours. Takes feeds well. No vomiting since admission. Stools are relaxed and green. Taking 18 drops of ol. Morr. daily (Divided doses of 3 drops between feeds)

15.1.27. Baby's weight has been stationary for 5 weeks at 8 lbs. The chest is clear. Stools are green and relaxed. Bowels open 3 times in the 24 hours (Previously averaged 4 motions daily) No vomiting since admission. General condition of baby is poor. Child to have 3 oz. of raw milk (unboiled and undiluted) every 3 hours. Continue with cod liver oil.

24.1.27. Has gained weight from the commencement of the raw milk treatment. Takes feeds well and is satisfied. Baby getting quite bright. Smiles readily. Stools green but not relaxed

now. Not offensive. Stools have always been green since admission.

7.2.27. Remarkable improvement in weight and general condition. Everything going well. Stools now formed and pale. Baby very bright. Flesh getting quite firm.

11.2.27. Vomited after 12 o'clock feed yesterday, and again at 4 p.m. Baby seems perfectly well and happy. Stools white, extremely offensive, and full of large fat particles. To have ol. Ricin Statim and feed meanwhile every 6 hours.

13.2.27. No symptoms. Revert to feeds every 3 hours. Baby very happy. Smiling.

14.2.27. Weight 10 lbs. 8 oz. Abdomen natural. General condition splendid.

21.2.27. Baby's limbs splendidly firm and she is in excellent condition. Happy and content-ed. Still gaining weight. Now on 4 oz. feeds. Stools pale but otherwise normal. Not offensive.

28.2.27. Weight is now 11 lbs. 10 oz. Baby in perfect health; a very beautiful specimen. Her flesh is very firm.

4.3.27. Improvement maintained. There is no doubt that the "rickety rosary" is less marked than on admission. Stools normal - pale.

7.3.27. Weight 13 lbs. 4 oz.

Baby discharged in perfect health.

Weight Chart.

Date.	lbs.	oz.
3.12.26.	8.	4.
10.12.26.	8.	0.
20.12.26.	8.	0.
27.12.26.	8.	0.
3.1.27.	8.	0.
10.1.27.	8.	0.
17.1.27.	8.	4.
24.1.27.	8.	8.
31.1.27.	8.	14.
7.2.27.	10.	0.
14.2.27.	10.	8.
21.2.27.	11.	8.
28.2.27.	11.	14.
7.3.27.	13.	4.

Remarks.

The response to feeding with whole milk was immediate. There was a slight attack of vomiting on the 10th of February, which responded at once to a short period of relative starvation.

The family history was good, and therefore the constitutional inheritance was good. The catarrhal manifestations of rickets were seen not only in the alimentary tract, but also in the chest. The aetiological factors were :-

(1) Factor of deficiency

(2) Secondary infection, enteral, and parenteral.

(3) Factor of Faulty Hygiene.

Case II. Lily M^{c} C. aet. 8 months. Admitted to Ward II on 24.1.27.

History.

Baby from first pregnancy. Born at term: normal labour. Weight at birth 5½ lbs. Breast fed from birth every 3 hours. Baby progressed normally until the last two weeks, when she has been very fretful and"chesty". Has a cough. Motions are green. No vomiting.

Family History.

Mother is a pale anaemic young woman (aet. 22) Has had no serious illnesses in the past except influenza. Health during pregnancy was good, but has felt very tired recently. Attributes this to strain of nursing the baby.

The father has always been strong and well.

No tuberculosis on either side of family.

Examination. Temperature 98°

A breast-fed baby of 8 months with a marked "rickety rosary." Abdomen is protuberant. Has impetiginous spots on scalp and face. Muscles are flabby: child fretful. Skull: no changes of rickets detected. Heart: natural: Lungs: Generalised rhonchi, and scattered crepitations at both

bases. The weight is 13 lbs. 4 oz. Badly nourished infant.

Dietetic treatment. To have milk 4 parts, water 2 parts, and lactose 1 drachm in 6 oz. feed every 3 hours. Give 5 drops of ol. Morrhui between feeds.

28.1.27. Child taking feeds. Very fretful. Apyrexial. Chest condition in statu quo. Weight unchanged. Stools frequent, green, and slimy. Impetiginous eruption is better than on admission.

8.2.27. The baby is brighter, but has lost weight. Chest clearing up. Still some scattered rhonchi. Stools still relaxed and green. Give Hyd. c. cret. gr. ¼ t.d.s.

14.2.27. Has gained 2 oz. this week. Lungs are now clear. Stools slightly better. Baby has always been fretful since admission. Cannot be made to smile. Scalp quite clear now.

18.2.27. Child vomiting immediately after feeds for last 24 hours. Vomiting said to be sudden and effortless. Baby is fretful. Tongue is furred. Stools relaxed and green. Abdomen is soft and slightly distended.

There is a superficial ulcer under the right axilla and slight conjunctivitis and blepharitis of right eye. To have nothing but boiled water for 12 hours, and 1 drachm ol. Ricini statim.

22.2.27. Still occasional vomiting. Stools green and slimy. To-day the skin of the napkin area is inflamed and tender. (Dermatitis subsequently traced to soda used in hospital laundry) Baby very fretful. Has lost weight.

1.3.27. Stools are now fairly normal. Still occasional vomiting about 20 minutes after food. Ward sister describes vomiting as being of cerebral type. Abdomen is soft and natural. No catarrh of lungs, but profuse nasal discharge. Axillary abscess is better. Napkin dermatitis is better. Put child on whole milk with sod. citrate grains 6 to each bottle every 3 hours.

5.3.27. No vomiting since being put on whole milk (citrated) Stools now normal. Baby is less fretful.

8.3.27. Has lost 3 oz. yet looks much better. Stools are variable, but fairly normal.

Baby pale and flaccid, but brighter. No physical signs in chest. No ear discharge. Abdomen is normal on examination.

Try child on Thyroid gr ½ t.d.s.

9.3.27. Pale green stools. No vomiting. Baby's eyes are brighter. Smiled.

10.3.27. Stools pale and soapy.

11.3.27. No vomiting. Temperature always sub-normal. Stools pale and soapy. Child is brighter and more friendly.

15.3.27. Has now been having Thyroid gr. ½ t.d.s. for one week. Child looks better but has lost 2 oz. Omit Thyroid altogether. Doses may have been excessive. Stools offensive, pale, soapy, and adhere to napkins. No vomiting. Baby is much brighter and better in spite of having lost 2 oz. in weight. Give the raw cow's milk without any citration.

16.3.27. Stools, pale green.

17.3.27. Improving. General condition is much better. Smiles and is now quite bright. Temperature is always sub-normal. Abdomen, slightly protuberant. To-day the stools are normal for whole milk feeding - slightly

pale.

18.3.27. Pale green stool: normal in consistence.

19.3.27. Pale green stools, slightly relaxed. Three motions in last 24 hours. The general condition of baby is still improving.

21.3.27. Pale yellow, soapy stool. Bowels rather relaxed.

22.3.27. Baby is much better. Smiles and "sings". Takes feeds well. No vomiting. Sleeps well and looks well. Temperature always sub-normal - Taking 5 oz. to each feed. Do not increase feed.

23.3.27. Rather pale, normal stool.

24.3.27. Normal stool. Improvement in baby is continuous.

25.3.27. Normal stool. Baby is getting along splendidly.

27.3.27. Normal stool. Gained 12 oz. last week. Smiles and "sings". Flesh noticeably firmer. Great improvement in general condition. Taken home by parents.

Weight Chart.

Date	lbs.	oz.
24.1.27.	13.	4.
28.1.27.	13.	4.
8.2.27.	12.	6.
14.2.27.	12.	8.
28.2.27.	12.	0.
2.3.27.	11.	9.
9.3.27.	11.	6.
14.3.27.	11.	4.
21.3.27.	11.	12.
27.3.27.	12.	8.

Remarks.

It was most unfortunate that this baby was removed just when real improvement had begun. The parents were delighted at seeing such an improvement in the baby, and insisted upon taking her home.

The case illustrates severe catarrhal rickets with marasmus in a baby fed from birth on the breast for 8 months. The secondary infection of the catarrhal alimentary canal was of severe nature, and inhibited assimilation for a long time.

Parenteral infection was also present, and further jeopardized recovery, which was eventually good.

Thyroid Extract gr ½ t.d.s. was tentatively given for one week. Such is the dose recommended by J.W.Simpson in the Scottish Medical and Surgical Journal of December 1906.

The Aetiological factors in this case are:

(1) Factor of Deficiency. Very strongly marked.

(2) Secondary Infection.

(3) Factor of Faulty Hygiene.

Case III. Ellen F. aet. 4½ months. admitted 27.2.27.

History:

This infant was sent from St. Luke's (Poor house) with the history "Premature infant, fed from birth on "Almata". Progress has always been slow, and for the last 3 days baby has had green stools and vomiting after feeds."

(The mother of the infant, Mrs F. aet. 42 was transferred from St. Bartholomew's Hospital to the Holborn and Finsbury Hospital ten days ago, as a case of inoperable carcinoma of cervix. From this poor woman the following points in the history have been obtained)

The baby was premature - 7½ months. Labour was natural. At birth baby weighed 5 lbs. but seemed strong. Mother was delivered at home, but was sent into St. Bartholomew's Hospital the following day. The baby was sent to St. Luke's Workhouse.

Family History.

Father healthy

Mother very ill and weak during pregnancy, and lost weight. This baby was her eleventh

child.

Seven children alive, all breast fed, and all healthy: eldest 19 years.

1st. Baby died at 6 weeks of "convulsion fits"

10th Baby died at 2 weeks of "convulsion fits"

One healthy child of 8 years died of shock, following severe burns.

No miscarriages.

Examination of baby.

Very small infant. Weight 6 lbs. Length is only 20½ inches. But infant is not markedly wasted. Very limp and flabby. There is just perceptible beading of 3rd and 4th ribs. Otherwise no signs of rickets, and no physical signs. Child fretful.

Treatment. Boiled water only for 12 hours, and one drachm of castor oil at once. Then to have 3 oz. of whole unboiled milk every 3 hours, with orange juice night and morning, and between feeds 3 drops of pure cod-liver oil.

Progress Notes.

28.2.27. Stools relaxed and green. No vomiting since admission. Has taken feeds well.

30.2.27. Taking feeds well. Baby is brighter.

No vomiting. Stools less green: Offensive.

1.3.27. Baby is progressing. Stools of normal consistence. Greenish and offensive. Bowels open twice in last 24 hours.

4.3.27. Stools normal in consistence. A mixture of light green and grey. Offensive. Curds present. Baby is better.

7.3.27. Has gained 10 oz. since admission. No vomiting since admission. Stools rather relaxed and greenish. Buttocks slightly inflamed. General condition of baby is greatly improved. Smiles and is very intelligent.

10.3.27. Continued improvement. Normal stool this morning but for one large curd.

14.3.27. Looking bright and well. No vomiting: no symptoms. Stools relaxed and greenish again. Gained 8 ounces in last week. Continue with 3 oz. feeds.

18.3.27. Increase feed to 3½ oz. every 3 hours. Continued improvement in baby, but does not seem satisfied with feeds.

21.3.27. Uninterrupted progress. Gained 4 oz. in last week. Baby satisfied with feeds and

is very bright and smiling. Stools have been normal for 3 days. Continue with 3½ oz. feeds.

23.3.27. Baby very bright, and interested in surroundings. Everything going splendidly.

28.3.27. Continued improvement. Baby perfectly happy. Stools pale green with large fat particles. Bowels open on average 3 times in 24 hours. Has gained 6 oz. in last week. Give Liquid Paraffin, one drachm for next two evenings. There has been no excessive perspiration since admission, and the only evidence of rickets is the undoubted beading of 3rd and 4th ribs.

4.4.27. Has gained 5 oz. during past week. Flesh very firm. Baby particularly bright and well. Now measures 21 inches, i.e. ½ inch more than on admission. Abdomen is soft and natural: no protuberance. Stools practically normal. Increase feeds to 4 oz. every 3 hours. The beading of the 3rd and 4th ribs is just palpable.

Weight Chart.

Date.	lbs.	oz.
28.2.27.	6.	0.
7.3.27.	6.	10.
13.3.27.	7.	2.
21.3.27.	7.	6.
28.3.27.	7.	12.
4.4.27.	8.	1.

Remarks.

At the time of writing (4.4.27) this infant is still under observation.

The response to feeding with whole milk, cod liver oil in small doses, and orange juice, was immediate. It must be emphazised that the only bony evidence of rickets on admission was a beading of the 3rd, and 4th ribs, so slight that unless it had been specifically sought for, would have been entirely overlooked. The varying character of the stools is regarded as evidence of catarrh of the intestinal tract due to rickets. On admission there were signs of a mild secondary enteral infection evidenced by vomiting, and relaxed green stools. The rapid recovery is thought due to the infant's having come under treatment

comparatively early before greater damage from vitamin deficiency had occurred.

Aetiological factors in case :-

(1) Factor of deficiency

(2) Constitutional debility from prematurity.

The family history shows that eight children were successfully reared out of a total of eleven. Two only died in early infancy. In spite of the mother suffering from carcinoma cervici during pregnancy, apparently the vital impulse of the baby was strong.

(3) Mild secondary enteral infection.

(4) Factor of Faulty Hygiene.

Case IV. James A. aet. 6 months. Admitted on 21.12.26.

History.

This baby is one of twins: weight at birth 6 lbs. Other twin, a girl, weighed 8 lbs. at birth. Both twins were breast fed from birth for 2 months, when lactation ceased. Twins were taken to Infant Welfare Centre and put on "Trufood".

Patient progressed satisfactorily for another month. Then he developed whooping cough, and was admitted to M.A.B. Fever Hospital and detained for one month. On return home was "very chesty," and has not been thriving since. Coughs a good deal, and vomits occasionally after coughing. Stools are green. Sweats a great deal: pillow is always wet. Has been having feeds of "Glaxo" every 4 hours.

Family History.

Father a healthy man.

Mother, always healthy. During pregnancy health was good, and also during lactation. The other twin from this last pregnancy is

perfectly well. Five other children quite well - 4 were breast fed babies, and one bottle fed. Has had one miscarriage. Lost 3 children: One died of "fits" at 6 weeks. One of Tuberculous Meningitis at 3½ years, and one died of "Bronchitis and Pneumonia" at 1½ years.

Examination.

Very pale, limp little baby. Bones of skull show rickety softening. Very definite "rickety rosary"; abdomen protuberant. No enlargement of epiphyses at wrists or ankles. Skin wrinkled, and moist with perspiration. Subcutaneous fat very deficient. Lungs: scattered crepitations all over back of chest, and percussion note impaired at right base. Temperature on admission 98·2°. Weight 9 lbs. 8 oz. Heart sounds are natural.

Progress Notes.

27.12.26. Baby is better than on admission. Takes feeds well. Is having milk and water equal parts, with lactose one drachm in each feed of 5 oz. every 4 hours. Taking 5 drops of cod liver oil between feeds, and orange juice night and morning. Child has a spasmodic cough which induces occasional vomiting.

Perspires a great deal: Pillow is generally soaked. Lungs are less catarrhal. Crepitations at both bases: especially at right base where percussion note is impaired. Probably unresolved pneumonia. Temperature always sub-normal. Stools are relaxed, and green. Weight is unchanged.

4.1.27. Has gained 4 oz. Baby is improving, but is very fragile, and limp. Cough still troublesome. Chest condition in statu quo. Stools still relaxed, green, and often slimy. Takes feeds fairly well.

11.1.27. Gained further 2 oz. Increase feed to 6 oz. every 4 hours. Pneumonic process at right base is still unresolved. Baby can be induced to smile, but is very lethargic, and interest is hard to arouse. There is no improvement yet in the rickets: Excessive perspiration about the head - always preceded by very bright flushing of the malar regions of the face. Perspiration always induced by feeding.

17.1.27. Has lost 4 oz. Stools have been very relaxed, green and offensive, during the last week. A secondary enteral infection seems

likely. Chest condition in statu quo. Still perspires profusely. Baby's general condition is poor, and he is very lethargic. Does not cry and is not very fretful. To have Liq. Paraffin one drachm for next three evenings.

21.1.27. Condition is unchanged.

25.1.27. Has gained 7 oz. Stools better. Baby is brighter. Pneumonic process at right base still unresolved. Temperature always sub-normal.

30.1.27. Profuse sero-purulent discharge from left ear. Stools green and relaxed.

2.2.27. Has lost 4 oz. Otorrhœa still profuse. Stools very unsatisfactory. Perspires greatly.

8.2.27. Abdomen distended. Much sweating. Baby very fragile. Otorrhœa less profuse. Stools slightly better. Still no resolution at right base. Try undiluted cow's milk, and feed every 3 hours instead of every 4 hours. Give 5 oz. feeds. Baby has lost 1 oz.

14.2.27. Stools not so relaxed. Chest condition in statu quo. Baby is a little brighter. Otorrhœa is diminishing. Still perspires very much. Weight unchanged.

21.2.27. Has gained 3 oz. Still coughs frequently. Chest condition unchanged. Stools are variable; mostly green and relaxed, but sometimes pale and soapy. Perspiration is less marked. Abdomen protuberant. Beading of ribs as definite as on admission. The baby smiles occasionally. He is very limp.

28.2.27. No otorrhœa. Baby is brighter. Signs of commencing resolution at right base. Stools variable. Less frequently green, and less slimy. Weight unchanged in last week, but child's general condition is certainly better.

2.3.27. The perspiration is noticeably diminished and the baby is brighter. Stools now tend to be pale and soapy, but are sometimes pale green with small white curds. Takes feeds well. Has gained 1 oz.

8.3.27. Baby much better: improving now. Has gained a further 2 oz. Pneumonic process at right base not yet resolved. Stools vary much. Bowels open on average 3 times in the 24 hours. Baby smiles. Does not perspire so freely.

14.3.27. Has gained 5 oz. during the last week. General condition is much better: Baby brighter. Seems satisfied with feeds. Do not increase. Temperature is always sub-normal. No further resolution in lung. Stools are still variable, and successive stools are often of different types. Frequently, pale green and formed: sometimes pale and soapy: sometimes green and relaxed. Increase dose of ol. Morrhui to 10 drops between each feed.

28.3.27. Still a few crepitations at right base, but the process is resolving slowly. Baby's general condition is much improved. Is now taking 6 oz. of whole unboiled milk: always ready for feeds. The stools vary, and are sometimes normal. The most frequent type of stool now is the pale stool containing curds of soap and fat. Gaining weight: weight now 11 lbs. 5 oz. Abdomen is less protuberant. The excessive perspiration is diminishing steadily. Baby is bright and smiles readily.

4.4.27. Gained 7 oz. last week. The baby is improved in every respect, and seems upon

the high road to recovery at last. There are still a few occasional crepitations at right base when child is caused to inspire deeply. The stools are as before - variable, but on the whole are becoming more normal: the intestinal catarrh is obviously lessening. Though the excessive perspiration is still conspicuous, it is infinitely less than it was a few weeks ago. Abdomen still protuberant.

Weight Chart.

Date	lbs.	oz.
21.12.26.	9.	8.
27.12.26.	9.	8.
4. 1.27.	9.	12.
11. 1.27.	9.	14.
17. 1.27.	9.	10.
25. 1.27.	10.	1.
2. 2.27.	9.	13.
14. 2.27.	9.	13.
21. 2.27.	10.	0.
28. 2.27.	10.	0.
2. 3.27.	10.	1.
8. 3.27.	10.	3.
14. 3.27.	10.	8.
21. 3.27.	11.	0.
28. 3.27.	11.	5.
4. 3.27.	11.	12.

Remarks.

At the time of writing (4.3.27) this case of combined rickets and Atrophy is still under observation. One feels that a mistake was made in continuing so long with four-hourly feeds after ad-

mission to hospital. And the exhibition of whole milk feeding at an earlier date might have been profitable. However the intestinal catarrh was so marked that one hesitated until 8.2.27 before adopting undiluted milk for the feeding.

Recovery was further delayed by an infection of the middle ear, and by an apparent intestinal infection after coming under treatment.

The baby was greatly debilitated through the attack of whooping cough. Evidently this had been complicated by pneumonia which remained unresolved at the right base. One thinks that the lung lesion is not likely to be a pulmonary fibrosis, as there has been considerable improvement in the physical signs during the last fortnight. There was also a degree of congenital debility at birth, the baby weighing only 6 lbs, while the twin sister was 8 lbs.

The aetiological factors present in the case are :-

(1) Factor of Deficiency.

(2) Inferior Constitutional Inheritance.

(3) Secondary Infection - parenteral and enteral.

(4) Factor of Faulty Hygiene.

Case V. Rose Evelyn R. aet. 3 months. Admitted 19.11.26.

History.

This baby was admitted at the instigation of the Society for the Prevention of Cruelty to Children. The parents of the infant were said to be drunkards. The mother has never come to the hospital, so no history could be obtained. A neighbour visited the infant once, and declared it had been "brought up on gin."

On admission the infant was emaciated, verminous and dirty: there were many septic sores on the scalp and buttocks. A well defined "rickety rosary" was present, and affected the 3rd, 4th and 5th ribs. The abdomen was protuberant. Slight bronchial catarrh was present, but otherwise there were no physical signs.

In the first instance, the food mixture given was milk 4 parts, water 2 parts, lactose one drachm in a feed of 3 ounces every 3 hours. This was augmented by ol. Morrhui in 5 drop doses between feeds, and orange juice,

given night and morning. Appropriate treatment was given for the skin and scalp condition.

The condition of the stools after admission was bad. The motions were frequent, relaxed, and green. There was occasional vomiting, and the child was very fretful. The septic sores of the scalp and skin responded to treatment and by the end of December there were no physical signs in the lungs. The stools, however, always remained green and slimy, and the general condition of the child most unsatisfactory. Meanwhile the weight chart was typical of Bilanzstörung. It is here appended - up to the 8th of February 1927.

Date	lbs.	oz.
19.11.26.	5.	12.
23.11.26.	5.	12.
30.11.26.	5.	14.
7.12.26.	5.	10.
14.12.26.	5.	10.
21.12.26.	5.	12.
28.12.26.	5.	14.
4. 1.27.	5.	14.
11. 1.27.	6.	0.
17. 1.27.	5.	14.
25. 1.27.	6.	0.
2. 2.27.	6.	0.
8. 2.27.	6.	0.

On 8.2.27 whole milk feeding was substituted for the milk and water mixture. The following are abstracts from the notes.

15.2.27. Baby takes 3 oz. feeds well. Smiles and takes notice now. Her expression is much better, though the weight in still stationary at 6 lbs. The stools are less frequent, but still green.

18.2.27. Stools becoming more formed. Fluctuate in character, and are sometimes pale and greasy - at other times green. The baby is much brighter.

22.2.27. Baby has gained 1 lb. in the last week. She is becoming quite bright, and happy. Has had several normal stools, though somewhat paler in colour than is usual.

1.3.27. No further increase in weight. Nevertheless this baby is infinitely better and brighter since she has had the whole milk. Stools vary slightly, but on the whole are fairly normal. Child still perspires about the head occasionally.

8.3.27. Has gained a further 4 oz. General condition is still improving. Scalp now affected with mild seborrhoea. Increase feeds to 4 oz. every 3 hours.

11.3.27. Scalp almost quite well. Baby looks well, and is much happier. Stools pale and rather constipated.

12.3.27. Large pale soap stools. Scalp is quite healed.

15.3.27. Normal stool this morning. Baby is improving greatly. Smiles very readily now. Has gained 6 oz. Increase feeds to 4½ oz. every 3 hours.

16.3.27. Pale soap stool.

17.3.27. Contented, and improving in every way.

Takes feeds well.

18.3.27. Stools pale, and dry.

19.3.27. Pale, dry stool with small white pellets. Baby much better. Recently perspiration about the head has ceased.

22.3.27. General condition is now good. Baby is bright, and intelligent. The eyes are very bright. Takes feeds well and seems satisfied. Has gained 10 oz. Flesh is getting firmer. Bowels open twice in the 24 hours. Stools often normal in last few days.

23.3.27. Normal stool.

24.3.27. Constipated pale stool.

25.3.27. Normal stool. Abdomen is much more natural. There is still a little undue protuberance. Baby is happy and well. Increase feed to 5 oz. every 3 hours.

27.3.27. Very bulky soap stool. Baby has gained 2 oz.

28.3.27. Stools normal to-day.

29.3.27. Normal stool. Great improvement maintained in general condition. Baby is getting quite plump.

30.3.27. Bulky soap stool.

4.4.27. Gained 10 oz. last week. No physical signs in Lungs. Flesh is firm. Takes feeds splendidly. Baby very happy and smiling. Abdomen still unduly prominent, and "rickety rosary" present.

Weight Chart.

Date	lbs.	oz.
8.2.27.	6.	0.
15.2.27.	6.	0.
22.2.27.	7.	0.
1.3.27.	7.	0.
7.3.27.	7.	4.
14.3.27.	7.	10.
21.3.27.	8.	4.
28.3.27.	8.	6.
4.4.27.	9.	0.

Remarks.

This infant is still under observation. The main interest of the case is the rapid response made to whole milk feeding, which was begun when the infant's stools were still green and slimy. On admission, the gastro-intestinal symptoms pointed to the presence

of an enteral infection.

Aetiological Factors :-

(1) Factor of Deficiency

(2) Hygienic Factor. Neglect (3) secondary enteral infection

Case VI. Kathleen May W. aet. 6 months.

Admitted 14.2.27.

History.

3rd child of family.

Baby born at term after normal labour. Weight at birth 6 lbs. For 6 weeks was breast fed every 3 hours, and progressed favourably. Then lactation ceased. Baby was put on Nestlé's Milk for 2 months, and on account of loss of weight was brought to the Infant Welfare Centre, and put upon a milk and water mixture. The wasting continued; and the stools became green, slimy, and frequent. Glaxo was then tried, without success; Mother then took baby to her own Doctor who advised a milk and water mixture. After a few days diarrhœa and vomiting started, and for the last month child has been very ill, and getting much thinner. Still vomits occasionally, and stools are always green and relaxed. Recently the baby has been fed on "Cow and Gate".

Family History.

Mother looks healthy. Says she suffers from Bronchitis, and had a cough during most of pregnancy. Otherwise felt fairly well. Her first husband died of Phthisis. Father

of patient is perfectly healthy.

One child of first marriage, a boy, breast fed and healthy. One other child of 2nd. marriage. This girl was fed on Nestlé's milk from birth, and is quite well.

Examination.

Emaciated infant: Very pale: Skin very inelastic. Very fretful. Abdomen protuberant. No physical signs in chest. No evidences of rickets in any of the bones. Weight is 8 lbs. 10 oz. Baby shows the "Geographical Tongue". Scalp and Skin are healthy.

Treatment.

To have 3 oz. of whole unboiled milk every 3 hours, and 5 drops ol. Morrhui between feeds. Also, orange juice night and morning.

16.2.27. No vomiting since admission. Stools green and offensive. Bowels open 4 times in 24 hours. Child takes feeds well. She is very fretful.

18.2.27. Has had ol. Ricin once, and Hyd. c Cret. gr ¼ t.d.s. for last 2 days. Tongue is now red and fleshy. No vomiting. No sweating about the head has been noticed. Stools

green with white pellets.

22.2.27. Weight stationary. Child is brighter than on admission, and will smile. Sleeps well: Takes feeds well.

28.2.27. Tongue natural. Stools greenish, offensive, relaxed, and containing curds. No vomiting since admission. Baby certainly seems better but has not gained weight.

4.3.27. Stools grass green. Tongue natural. Baby smiles, and general condition is undoubtedly better.

5.3.27. Stools pale green, with some whitish curds.

7.3.27. A mixed stool. Pale and soapy in parts; in others, green.

8.3.27. Has gained 12 oz. Improvement in general condition is in accord with this fine gain.

9.3.27. Green stool containing much fat.

10.3.27. Stools dark green and full of curds. Give Liquid paraffin, 2 drachms statim.

11.3.27. Stools better.

12.3.27. Pale stool, adherent to napkin. Stool contains many yellow masses about the size of a split pea.

13.3.27. No yellow particles to-day. Stool is

pale and homogeneous. Bowels are open now twice daily.

14.3.27. Baby has gained 2 oz. She is decidedly better in every way, and quite bright. Smiles readily. Is now taking 4½ oz. feeds. Stool to-day is pale green, dry, and crumbly. Does not adhere to napkin.

16.3.27. Greasy pale homogeneous stool adherent to napkins.

17.3.27. The baby seems better each day. Stool to-day, slightly pale, otherwise normal.

18.3.27. Slightly green stools with some white fat pellets.

19.3.27. Pale stool with yellow curds of fat.

21.3.27. Normal stool.

23.3.27. Baby contented. Very bright. General condition becoming good. Eyes are bright. Flesh is becoming firmer. Abdomen natural. No physical signs in chest. Has gained a further 2 oz. Increase feed ½ oz. To-day stool is pale green with white pellets.

24.3.27. Normal stool.

25.3.27. Scanty soap stool.

26.3.27. Scanty soap stool, with much fat present.

27.3.27. Normal stool.

28.3.27. Improvement maintained. Very happy and contented. Gained 4 oz. last week. Stool pale and greasy this morning.

30.3.27. Scanty normal stool. Give liq. paraffin one drachm statim.

2.4.27. Pale soap stool with fat curds. Baby perfectly happy, and improving daily.

4.4.27. Normal stool.

5.4.27. Gained 10 oz. last week. Corresponding improvement in general condition. Lungs: natural. Abdomen slightly protuberant. Always bright and smiling. Never any sign of rickets. To be discharged.

Weight Chart.

Date	lbs.	oz.
14.2.27.	8.	10.
21.2.27.	8.	10.
28.2.27.	8.	10.
7.3.27.	9.	6.
14.3.27.	9.	8.
21.3.27.	9.	10.
28.3.27.	9.	14.
5.3.27.	10.	8.

Remarks.

On admission to hospital this infant was 6 months old. From the age of two months there had been some degree of marasmus, and the history suggests that a severe gastro-intestinal infection had supervened.

The family history is not very satisfactory, and the possibility of tuberculosis in the mother is not remote.

There were no signs of rickets in the bony skeleton nor was there any unusual perspiration.

The very great variability in the stools noted in this case one finds characteristic in these infants, after green, relaxed, and slimy motions have ceased. Whole Cow's milk feeding was well borne.

The aetiological factors present were :-

(1) Factor of Deficiency

(2) Inferior Constitutional Inheritance

(3) Enteral infection.

(4) Factor of Faulty Hygiene.

Case VII.

Lucy Mary H. aet. 11 weeks. Admitted 5.2.27.

History.

Child born at term: Labour normal: Weight at birth 6½ lbs. Fed on breast for 2 weeks: then lactation ceased. "Cow and Gate," "Glaxo", and milk and water mixture tried successively, but baby did not progress. Child was fed regularly every 3 hours. The bowels have never been regular. Constipation and diarrhoea have alternated. Mother says that rectum has come down several times with straining. Two weeks before admission child vomited after feeds on several occasions, but not since.

Baby is wasting.

Family History.

Mother is young, and looks healthy. Health during pregnancy was good, except for very obstinate constipation. Health previously, always good.

No familial diseases.

Father has a cough, but is always healthy.

No tuberculosis in his family.

Patient is first child of marriage.

Examination. A very pale wasted little baby. Weight only 6 lbs 4 oz. Very limp and lethargic. Abdomen protuberant. There is a definite rickety rosary, in this infant: Otherwise no physical signs. Anus natural. P.R. examination negative.

Treatment. To have orange juice night and morning, and 3 drops ol. Morrhui between each 2 feeds. Give whole milk 2 oz. every 3 hours.

6.2.27. No vomiting since admission. Stools relaxed, green, slimy and offensive. Child sweats profusely about the head during feeding. Takes feeds well.

7.2.27. This morning the stool is pale, formed, and crumbly. No vomiting. Always ready for feeds. Baby is brighter.

25.2.27. Weight is now 7 lbs. Baby fragile and skin very white, but is much improved in every way. Feeding always induces perspiration. Baby is not fretful. Stools vary greatly in colour and consistence. Increase feed to 3 oz. every 3 hours.

4.3.27. Stools formed. Very pale green containing curds. Not offensive. Has gained a further 2 oz. Smiles and is quite bright. Perspiration is a little less than on admission, but always comes on during feeding. Abdomen still protuberant. Do not increase feed. No vomiting since admission. Temperature has always been sub-normal.

6.3.27. Pale green, formed stool, but no curds this morning.

9.3.27. Baby continues to improve. Stools are pale green.

10.3.27. This morning, a pale yellow soapy stool.

11.3.27. Gained a further 2 oz. Baby smiles, and general condition is improving. Red lips a contrast to very white skin. Increase feed to 3½ oz. every 3 hours.

12.3.27. Very pale green, formed stool.

14.3.27. Normal stool.

15.3.27. Normal stool. Baby is always improving. Perspiration decidedly less.

16.3.27. Clay coloured formed stool.

18.3.27. Baby bright and smiling. Small pale soap stool. To have liq. paraff. one drachm each night for 3 days.

19.3.27. Normal stool. Gained 5 oz. last week.

20.3.27. Pale dry crumbly stool.

21.3.27. Normal stool.

24.3.27. Normal stool.

25.3.27. Weight stationary this week. Baby is nevertheless continuing to improve. Smiles readily. Abdomen protuberant - soft. Beading of ribs as on admission. Sweats often during feeding, but not invariably now. Increase feed to 4 oz. every 3 hours.

26.3.27. Normal stool.

27.3.27. Normal stool.

28.3.27. Normal stool. Baby very bright, and contented. Sleeps well. Temperature always sub-normal since admission. Takes feeds well, and seems satisfied. Increase dose of cod liver oil to 5 drops.

29. 3.27. Normal stool. This baby is making great progress. Very happy infant.

1.4.27. Has gained 8 oz. and there is corresponding improvement in general condition. Baby is perspiring less and is very contented.

4.4.27. Normal stool. Child always improving.

7.4.27. Stools normal now. Continued improvement in every respect. Gained 4 oz.

Weight Chart.

Date	lbs.	oz.
5.2.27.	6.	4.
11.2.27.	6.	7.
18.2.27.	6.	10.
25.2.27.	7.	0.
4.3.27.	7.	2.
11.3.27.	7.	4.
18.3.27.	7.	9.
25.3.27.	7.	9.
1.4.27.	8.	1.
7.4.27.	8.	5.

Remarks.

This is an interesting case of atrophy associated with rickets in a baby aged 11 weeks. On admission the stools were relaxed, green, and slimy. Yet whole milk feeding was excellently borne, and the response to this feeding, and the exhibition of cod-liver oil was immediate. At the time of writing the infant is still under observation, and improving daily. The intestinal catarrh has ceased. One feels that if the cases could all be got at this comparatively early stage, severe

marasmus would be less frequently seen. The family history here seems fairly satisfactory, and the aetiological factors are therefore :-

(1) Factor of Deficiency

(2) Factor of Faulty Hygiene.

Case VIII. Elizabeth S. aet. 4 months. Admitted 10.1.27.

History:

Baby born at term. Weight 9½ lbs. Normal labour. Was breast fed for 5 weeks. Then "started to have fits, and go blue and limp." No twitching. Was taken to St. Bartholomew's Hospital, and detained for 15 weeks. Has only been home 4 days, and diarrhœa, and vomiting have been constant.

The following letter was later received from the Medical Registrar at St. Bartholomew's Hospital.

"Re Elizabeth S.

This child was in this hospital from 23rd. Oct., 1926, to 6th Jan. 1927.

On admission she had broncho-pneumonia, as well as diarrhoea and vomiting. Her weight was then 8 lbs. 4 oz. She was fed on protein milk for 5 days, and then dextrimaltose was added. From the middle of December she had diluted citrated cow's milk. Her weight was stationary at 8 lbs. 12 oz. from the beginning of November till December, when she commenced to gain, and was

discharged weighing 9 lbs. 9 oz.

Mr. Foster Moore examined the eyes, and gave it as a suggestion only that there was secondary optic atrophy".

Family History.

Mother's health during pregnancy was good. She has had Rheumatic Fever twice.
The father is a healthy man.
No Tuberculosis on either side of family.
Five other children of family alive and well.
Two children have died of "Convulsion fits" in infancy. Mother has had no miscarriages.

Examination.

Baby neglected, and dirty. Very badly nourished. Has congenital nystagmus. There is a definite "rickety rosary."
Abdomen protuberant, and distended: tympanitic: slight umbilical hernia. A few scattered crepitations at both bases.
Temperature 99°.
Child very fretful, and miserable. Heart natural.

Treatment. Boiled water only for 12 hours, and 2 drachms of castor oil at once. Then feed every 3 hours with skimmed milk. Give 3

drops ol. Morrhui between each 2 feeds, and orange juice one drachm night, and morning.

11.1.27. Baby looks more comfortable this morning. Stools slimy, green, and offensive. Has taken feeds well.
No vomiting. Temperature 97·8°.

13.1.27. No vomiting. Typical catarrhal child. Stools relaxed and green: 4 motions in last 24 hours. Weight 9 lbs.

16.1.27. No vomiting. Change feed to whole milk every 3 hours. Give 3 oz. feeds. Temperature sub-normal. Child fretful, and unhappy.

20.1.27. Stools very offensive, relaxed, and green. Baby takes feeds fairly well. Very fretful. General condition slightly improved. Lungs are now clear. Has gained 2 oz. since admission. The baby can certainly see quite well. Nystagmus is of rotary character.

27.1.27. Gained 4 oz. Do not increase feed. Stools slightly better: less slimy: 4 motions in 24 hours. Abdomen very protuberant. General condition a little better. This baby does not perspire noticeably.

3.2.27. Has gained 2 oz. Stools less green. Seldom formed. Generally 3 motions in 24 hours. Chest is clear. Has nasal discharge. Baby is less fretful. Takes feeds well. Increase feed to 3½ oz; every 3 hours.

10.2.27. Still has nasal discharge. General condition about the same. Stools are better. Gained 2 oz.

18.2.27. Lost 2 oz. A few scattered rhonchi in chest. Stools are relaxed again. Continue with same feed and give ol. Ricin 1 drachm statim.

25.2.27. Weight stationary. Chest is clear, and there is no nasal discharge. Stools green and offensive. Give liquid paraff. 1 drachm each evening for 3 days. Child has seborrhoea capitis.

4.3.27. Baby has been decidedly better in last few days. No physical signs in chest. Abdomen is softer. Seborrhoeic condition of scalp cured. Child not so fretful, and will smile occasionally. Baby has not been noticed to perspire unduly. Very definite "rickety rosary." Has gained 14 oz. Stools now large, pale, and soapy.

8.3.27. Large pale soapy stool.

9.3.27. Stools ditto.

10.3.27. Stools ditto.

11.3.27. Gained 8 oz. Corresponding improvement in child's general condition. She is very much happier now. Takes feeds well. Now having 4½ oz. every 3 hours.

12.3.27. Large, pale green, homogeneous stool.

13.3.27. Greasy white stool with fat pellets.

14.3.27. Pale crumbly dry stool.

15.3.27. Pale soap stool.

16.3.27. Pale crumbly soap stool.

17.3.27. Baby is rather slow to smile this morning: her general condition is still improving.

18.3.27. No gain in weight this week. No physical signs. Baby has just cut a tooth, which may account for failure to gain. Certainly she is improving.

19.3.27. Give 5 oz. feeds now. Stool this morning is pale, dry, and crumbly; contains much fat. Baby very bright this morning.

20.3.27. Much fat present in pale crumbly stool.

23.3.27. Stools ditto.

25.3.27. Gained 5 oz. Child's general condition very much better, and she is very happy now.

Her colour is better, and the eyes much brighter. Normal stool to-day.

27.3.27. Scanty, crumbly, green stools, with white particles.

28.3.27. Soapy, pale stool.

29.3.27. Normal stool.

30.3.27. Baby cutting another tooth. Stool to-day, pale green, and soapy. Homogeneous.

1.4.27. Gained 5 oz. Very bright and interested in surroundings. Pale grey, greasy stool, containing large curds.

4.4.27. Improvement maintained. Stools clay coloured, large and greasy. Two motions in 24 hours.

7.4.27. Has gained a further 6 oz. Great improvement in general condition.

Weight Chart.

Date	lbs.	oz.
13.1.27.	9.	0.
20.1.27.	9.	2.
27.1.27.	9.	6.
3.2.27.	9.	8.
10.2.27.	9.	10.
18.2.27.	9.	8.
25.2.27.	9.	8.
4.3.27.	10.	6.
11.3.27.	10.	14.
18.3.27.	10.	14.
25.3.27.	11.	3.
1.4.27.	11.	8.
7.4.27.	11.	14.

Remarks.

This baby is now making good progress though there are signs that the alimentary canal is not yet healthy. In this case also, whole milk, untreated, was well borne. The aetiological factors here are:-

(1) Factor of Deficiency.

(2) Inferior Constitutional inheritance (Family history unsatisfactory)

(3) Secondary infection - Enteral and Parenteral

(4) Factor of Faulty Hygiene. The baby was no sooner home from St. Bartholomew's Hospital than a fresh enteral infection manifested itself. On admission to the Holborn and Finsbury Hospital the baby was neglected and dirty.

Case IX. Rosie W. aet. 4 weeks. Admitted 11. 1. 27.

History.

7th child of family. Born at term after normal labour. Weight at birth 7 lbs.
Has been breast fed from birth every 3 hours, but has not progressed well, and during the last week has vomited shortly after each feed.
Mother thinks her milk is plentiful, but baby is wasting since the vomiting began. Stools said to be constipated. Baby has always had "Dummy teat".

Family History.

Mother is aged 43. Looks tired and anaemic. Has always suffered from Bronchitis. Apart from her usual cough, her health during pregnancy was good. She has always been thin. Did not get any fatter during pregnancy.
Has had one miscarriage. One baby died at 6 weeks through overlaying. All other children alive and well.
The father is a healthy man, wounded twice in the War.
No tuberculosis on either side of family.

Examination. Baby is very badly nourished: weight 6 lbs. Very fretful. No signs of rickets in bony skeleton. Skin very inelastic. Abdomen is soft. Not distended. Bronchial catarrh present. Heart natural. Temperature is 98·6°.

Treatment. Boiled water only for 6 hours, and 1 drachm of castor oil at once. Then give skimmed milk 1 oz. every 4 hours.

14.1.27. Stools are green, and offensive. 4 motions in 24 hours. Has vomited occasionally about 20 minutes after feed. Give 3 drops of cod-liver oil between each 2 feeds, and orange juice night and morning. A few scattered rhonchi in chest. Apyrexial.

18.1.27. No vomiting. Give 1 oz. feeds of whole unboiled milk. No gain in weight since admission. Stools are slimy, green, and relaxed. General condition of infant slightly improved. Chest is clear.

25.1.27. Has taken feeds fairly well, but has vomited occasionally. Stools green, and offensive, but less relaxed. Child not fretful now. No gain in weight.

2.2.27. General condition improved, but stools green and offensive. No further vomiting.

8.2.27. Has gained 1 lb. in last week, and seems much improved. Increase feed to 1½ oz. every 3 hours. Bowels now open 3 times in 24 hours. Stools still green, but becoming more formed. Baby smiled to-day.

15.2.27. Weight stationary at 7 lbs. Baby has regurgitated a little of each feed. Revert to 1 oz. feeds. General condition is better. Stools now light green, formed, and offensive. Bowels open 3 times in 24 hours.

22.2.27. Gained 2 oz. General condition is improving. Baby is more contented. Stools are much better.

28.2.27. Gained 2 oz. Stools clay-coloured, firm, and contain curds. Abdomen soft and natural. No physical signs in chest. Infant is quite bright. Does not seem satisfied with feeds. Increase to 1½ oz. every 3 hours.

7.3.27. Weight stationary. Baby takes feeds well: no vomiting. Pale bulky soap stools. Infant is much more lively, and flesh is firmer. Increase dose of cod-liver oil to 5 drops.

8.3.27. Pale, soap stool.

9.3.27. Pale, soap stools

10.3.27. " " " . Baby is improving. Increase feed to 2 oz.

14.3.27. Gained 4 oz. Smiles. Temperature consistently sub-normal. Stools to-day are dark green and frothy, and contain white pellets. To have liq. paraff., one drachm for 3 evenings.

17.3.27. Pale grey stool, mixed with green portions, and containing many small white pellets. Continue with liquid paraffin, and increase feed to 2½ oz.

19.3.27. Pale green stool with many white pellets.

21.3.27. Constipated homogeneous stool. Baby very bright. Continue liquid paraffin.

22.3.27. Gained 3½ oz. Flesh is becoming firm. Baby smiles, and is very contented - No physical signs.

23.3.27. Normal stool this morning.

25.3.27. Normal stool. Increase feed to 3 oz.

27.3.27. Normal stool.

28.3.27. Gained 5 oz. Great improvement in general condition. Temperature always sub-normal. This morning stools are dry and pale.

29.3.27. Normal stool.

30.3.27. Stools ditto. Infant very bright this morning.

1.4.27. Normal stool, but scanty.

2.4.27. Stools ditto. Give Hyd. c Cret. gr ¼ t.d.s.

3.4.27. Stool is in parts clay-coloured; in others green.

4.4.27. Normal stool.

5.4.27. Baby much improved. Smiles readily. Takes feeds well. Smiles readily. No physical signs in chest. Abdomen is natural. Has gained 6 oz. Increase feed to 3½ oz.

8.4.27. Improvement maintained. Has gained a further 2 oz. Stools normal this morning.

Weight Chart.

Date	lbs.	oz.
11.1.27.	6.	0.
18.1.27.	6.	0.
25.1.27.	6.	0.
2.2.27.	6.	0.
8.2.27.	7.	0.
15.2.27.	7.	0.
22.2.27.	7.	2.
28.2.27.	7.	4.
7.3.27.	7.	4.
14.3.27.	7.	8.
21.3.27.	7.	11½.
28.3.27.	8.	0½.
5.4.27.	8.	6½.
8.4.27.	8.	8½.

Remarks.

This infant of 4 weeks had been entirely breast fed from birth but had not been progressing. For one week before admission there was vomiting and constipation. There was no clinical evidence of rickets in the bony skeleton.

After admission to hospital the

stools were relaxed, and green for some weeks. Vomiting also occurred. Whole milk feeding was begun one week after admission. For some days afterwards occasional vomiting occured, but no change was made in the feeding. The weight remained stationary for 3 weeks. Thereafter the gain, though irregular, as is usual in these infants, was satisfactory. At the time of writing, the baby's general condition is excellent.

The enteral infection, which occured while the infant was still on the breast, was probably due to the use of the dirty "dummy teat."

The family history is fairly satisfactory, and in this case the aetiological factors are :-

(1) Factor of Deficiency.

(2) Enteral Infection. (The Bronchial Catarrh present on admission is presumed to have been a catarrhal manifestation of rickets.)

(3) Factor of Faulty Hygiene.

Case X. Florence M. aet 4 months. Admitted 15.3.27.

History. Born at term in City Rd. Maternity Hospital. Normal labour. At birth weighed 5 lbs. 10 oz. Baby was fed on breast for two months. As she was not progressing, was weaned, and put on cow's milk and water. Made no improvement on this feeding. Was then given Nestlé's Milk (according to directions on tin) and seemed to improve for a time. Suddenly diarrhœa started - "motion kept pouring from her." Feeding with Nestlé's Milk has been continued. Diarrhœa has lasted two weeks. Baby has become very thin. No vomiting.

Family History.

Pale tired-looking little woman of 34 (Looks 10 years older) Extremely untidy. Has "never been strong," but no serious illnesses in the past. Was fairly well during pregnancy until about a week before baby was born. Then Chimney went on fire, and this gave her a great shock, and she "did not get over it for a long time."

The father suffers from Asthma, and Bronchitis.

He has been out of work for 3 years.

No Tuberculosis on either side of family.

Patient is 6th child of family. All previous babies have been fed on breast. Three are alive and healthy. One child died at 1 year "through fright of the air raids". One died aged 2 years, of pneumonia following measles.

Mother has had no miscarriages.

Examination.

A very small little baby for 4 months. Very limp. Skin is inelastic and poor. Wasting is not extreme. Infant weighs 7 lbs. only, but is very small in length. The abdomen is slightly protuberant - soft. Heart normal: Lungs natural. There is just palpable beading of the 3rd and 4th ribs. Throat natural. Infant has seborrhoea capitis. She is very fretful. Temperature 98°.

Treatment. To have 3 oz. of untreated cow's milk every 3 hours: orange juice one drachm night and morning; and 5 drops of cod-liver oil between each two feeds. Give one drachm of castor oil statim.

Progress Notes.

16.3.27. Baby has taken feeds, and slept well. Stools are dark brown and relaxed.

17.3.27. Baby is more peaceful. Takes feeds well. No vomiting. No diarrhœa. Bowels have been open twice in last 24 hours. Stools offensive, and brown.

18.3.27. A crumbly pale stool this morning.

19.3.27. Crumbly pale stool.

20.3.27. Crumbly pale stool. Baby is contented and smiles - Give Liq. Paraff., one drachm this evening.

21.3.27. Pale green, formed crumbly stool. Repeat liquid paraffin. Seborrhoea Capitis is cured.

22.3.27. Normal Stool. Gained 1 lb. since admission. Baby is very bright and happy.

24.3.27. Constipated Stool: honogeneous, and of normal colour. Give liquid paraffin again. for 3 nights.

25.3.27. Crumbly soap stool. Baby improving with great rapidity. Has gained another 4 oz. Abdomen is normal. Does not perspire. Give 3½ oz. feeds.

26.3.27. Rather constipated pale Stool.

27.3.27. Normal stool.

30.3.27. Normal Stool. Baby improving daily.

1.4.27. Normal stool. Child is very interested in her surroundings. Everything going well. Smiles: A very nice-looking little baby. Has gained 4 oz.

2.4.27. Normal Stool. Increase feeds to 4 oz.

4.4.27. This morning stool is pale, crumbly and adherent to napkins. The baby is always improving. Gained a further 4 oz.

8.4.27. General condition is excellent. Great improvement daily. Beading of ribs is just perceptible, and seems less than on admission. Flesh is firm and healthy. Stools are normal. Abdomen soft, and natural. Baby contented and smiling. Has gained a further 5 oz.

Weight Chart

Date.	lbs.	oz.
15.3.27.	7.	0.
22.3.27.	8.	0.
25.3.27.	8.	4.
1.4.27.	8.	8.
8.4.27.	8.	13.

Remarks.

Apparently the mother exaggerated the degree of diarrhoea. Within two days the number of motions was reduced to two daily.

The whole milk, and cod-liver oil were excellently borne, and improvement began at once. The infant is now in splendid condition. One feels that the rapid response to treatment is to be ascribed to the exhibition of anti-rachitic vitamin before gross damage had occurred in the alimentary canal, and in the infant's general condition.

The aetiological factors in this case appear to have been :-

(1) Factor of Deficiency.

(2) Factor of Faulty Hygiene.

(3) Factor of Inferior Constitutional Inheritance. Present in slight degree only.

(4) Mild enteral infection may have been present.

VI. Summary and Conclusions.

The writer has found infantile atrophy to be so frequently associated with rickets that this has not seemed mere coincidence. A closer comparison of the two conditions has resulted in the opinion that the initial symptoms of digestive derangement in atrophic infants may be in many cases the result of intestinal catarrh of rachitic origin. Deficiency of anti-rachitic vitamin in the mother's diet is believed therefore to be the first factor in the production of infantile atrophy.

The actual onset is thought to depend upon additional factors, namely, inferior constitutional inheritance, secondary infection, and defective hygiene, in which may be included various errors in feeding. All of these exciting factors may be present in the one case. Owing to the infant's environment, an invariably present exciting factor is defective hygiene, though the component, improper feeding, may be absent.

On this theory, the first line of treatment is to supply anti-rachitic vitamin. Cod-liver oil and malt, exhibited in every conceivable way, has been unsuccessful in the writer's hands. The usual effect of this preparation was to inhibit digestion. After much experiment and error with the pure Ol. Morrhui it was found to be well tolerated when given in doses of two to ten drops midway between feeds.

Early cases of marasmus have responded well to this treatment. More advanced cases of nutritional disturbance with severe digestive derangement take a longer time to respond. When the factor of inferior constitutional inheritance is very marked, or severe infection present, response to vitamin replacement may not occur.

Whatever method of feeding is adopted it is essential to supply the anti-rachitic factor in this way. The various forms of dried, and modified milks are generally adequate as regards the growth factor, Vitamin A., but all are deficient in the anti-rachitic substance. The same remark may apply to fresh cows' milk, which is always of variable vitamin content. In addition it is

thought highly desirable to give the infant orange juice night and morning to augment any deficiency of the anti-scorbutic principle.

Owing to the large number of atrophic infants in this hospital it has been possible to compare the effects of various methods of feeding. The 10 cases described in Series II were treated with whole Cows' milk, some from the commencement of treatment, and others at later stages. One found that in general whole cows' milk was as well borne in atrophic infants with digestive derangement as any of the more orthodox food mixtures in vogue. That no one food has any specific virtue in all cases is demonstrated by the fact that so many varieties of food have been advocated by experienced authors. None has proved uniformly successful, nor has whole milk feeding in the writer's hands. Nevertheless the number of wasted infants who have been able to tolerate the whole milk has been unexpectedly high. In some cases of intolerance the addition of from 3 to 6 grains of Sodium Citrate to each feed has enabled the whole milk feeding to be continued. One advantage of the method is that feeds, small in bulk but of high nutritive value, are supplied, whereas with

other methods the feeds must be larger as the caloric needs of the marasmic infant exceed those of the normal baby. Three-hourly intervals between feeds were found to be more successful than four-hourly intervals.

The milk (from a mixed herd) is transferred to jugs. These are covered, and stand in iced water until the milk is required for use. The feeding bottle is filled, and then held for about one minute in hot water in order to take the chill from the milk. In this way the vitamin content of the milk is preserved in the fresh, natural state.

Just as in many adults the drinking of fresh cows' milk induces a degree of constipation, so it has seemed to have a similar effect upon some atrophic infants with relaxed, green stools. When this occurs there is a decided advantage as the slower passage of the food along the intestinal tract allows more time for absorption, and nutrition is correspondingly benefited. Should constipation supervene, liquid paraffin in one drachm doses once daily has been found to be a very satisfactory laxative, and can be given

indefinitely if required.

Some may take exception to this method of raw milk feeding on the grounds that there is grave risk of infection with the Bovine type of Tubercle Bacillus. On the other hand, many experienced clinicians believe that exposure to tuberculous infection from infancy results in the production of specific antibodies which protect against the disease. The writer is of this opinion, and further believes that tuberculosis is never likely to develop in children other than in those whose parents are tuberculous. In these cases the development of slight glandular tuberculosis may even be an advantage. The glandular affection generally responds to treatment, and after cure the subjects have often a degree of comparative immunity to the development of the infinitely more lethal pulmonary form of the disease.

The extreme variability in the stools of atrophic infants has been previously noted. Indeed, the green diarrhœal motion would appear to be the only type of Stool with which definite improvement in the child's general condition may not co-exist.

The well-known therapeutic effect

of good nursing has been seen in the writer's cases. The best results were always obtained in those wards where the nursing was most efficient.

Conversely, bad hygienic conditions and neglect are potent factors in favouring the onset of atrophy. Until the hygienic conditions of the poor are improved much disease is inevitable, especially amongst infants and children. Nevertheless one believes that the prophylactic administration of cod-liver oil to these expectant and nursing mothers, combined with giving small doses to the infant from birth, would reduce the incidence, not only of rickets and marasmus, but also of many other diseases which exact daily a heavy toll of infant life in the slums.

F i n i s.

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